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FIELD, GARDEN AND ORCHARD CROPS OF THE BOMBAY PRESIDENCY

BY

G. A. GAMMIE

Revised and Enlarged (1928)

BY

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PREFACE TO THE FIRST EDITION

The following notes are the result of eight years' observation in the farms and orchards of many parts of the Bombay Presidency. They are now drawn up and published primarily for the use of students and those interested in the neglected but important subject of Agricultural Botany.

The botanical diagnoses of orders, genera and species are, in all cases, restricted so as to elucidate only the plants actually described. An illustrated edition, with additions and corrections, will probably be ready for publication in two years' time.

POONA, *July* 1907. G. A. GAMMIE.

PREFACE TO THE SECOND EDITION

When the first edition of this publication was exhausted, the present writer undertook the preparation of a new edition. The lines on which the revision was to be done were settled in consultation with the Director of Agriculture of the Bombay Presidency.

Much of the purely morphological description of the plants has been retained as in the original edition. Some crops have been added and one omitted. Certain crops grown in restricted localities have been mentioned at the end of sections dealing with allied crops. There is, however, a great deal of entirely new material and the changes introduced will, it is hoped, enhance the usefulness of the book to district officers, students and the general public. Such changes include sections on crop diseases, notes on pollination, etc. The botanical names of plants and plant families have been brought up to date and a glossary of botanical terms added. The statistics of each crop for the Presidency are also brought up to date.

The writer acknowledges his indebtedness to Dr. W. Burns for help and suggestions at all stages of the work : to Dr. B. N. Uppal and Mr. T. N. Jhaveri for information regarding fungous and insect diseases of crops : and especially to Dr. B. N. Uppal for his very valuable assistance in revising nomenclature and in criticising and rearranging the manuscript.

G. B. PATWARDHAN.

College of Agriculture, Poona :
October, 1928.

SYNOPSIS OF THE FAMILIES DEALT WITH IN THIS BOOK

A. DICOTYLEDONS

Stems with separable wood and bark: *leaves* with netted venation: *embryo* with two or more cotyledons.

Flowers with petals free from one another .. **1. Polypetalæ** (P. i).

Flowers with petals united .. .. **2. Gamopetalæ** (P. iv).

Flowers usually without a corolla and also unisexual .. .. .. **3. Apetalæ.** (P. v)

1. Polypetalæ.

(*a*) *Stamens* and *petals* free from the calyx and ovary.

Small trees: *sepals* and *petals* in series of 3 in each whorl: *stamens* sessile, indefinite; *fruit* an aggregate of carpels. *Products*: edible fruit .. .. **1. Anonaceæ** (P. 1).

Herbs: *sepals* 2, soon falling; *petals* 4, fragile; stamens indefinite; *ovary* with parietal placentation and sessile discoid radiate stigmas. *Products*: opium.. **2. Papaveraceæ** (P. 2).

Herbs; *petals* 4, cruciform; *stamens* tetradynamous: *fruit* a siliqua or silicula. *Products*: vegetables, oil seeds .. **3. Cruciferæ** (P. 2).

Herbs with entire leaves and membranous or hairy appendages at the nodes: *sepals* 2; *petals* 4 to 5; *style* divided: *fruit* a capsule. *Product*: vegetable .. **4. Portulacaceæ** (P. 6).

Shrubs: *leaves* palmate: *sepals* united; *epicalyx* present; *petals* 5, contorted, showy; *stamens* indefinite, monadelphous: *fruit* a loculicidal capsule. *Products*: vegetables fibres, oil seed .. **5. Malvaceæ** (P. 6).

A shrub : *leaves* palmately nerved : *sepals* free : *petals* small ; *stamens* numerous, on a top-shaped disk : *fruit* a small, lobed drupe. *Products* : fruit .. **6. Tiliaceæ** (P. 13).

Herb : *flowers* in corymbose panicles, sepals 5 ; *petals* 5, blue or white ; *stamens* 5 ; ovary five-celled : *fruit* a capsule. *Product* : oil seed .. .. **7. Linaceæ** (P. 14).

Small trees : *leaves* pinnate : sepals 5 ; *petals* 5 ; *stamens* 10 : *fruit* an oblong, angled berry. *Product* : fruit .. **8. Geraniaceæ** (P. 15).

Trees or shrubs, abounding in fragrant essential oil : *calyx* with *sepals* free or combined ; petals 4 or 5 ; *stamens* few or indefinite : *fruit* a hesperiduim or shelled drupe. *Products* : fruits .. .. **9. Rutaceæ** (P. 15).

A tree : *leaves* usually white woolly beneath : *flowers* small ; *stamens* 5, opposite the petals : fruit a drupe. *Product* : fruit .. .. .. **10. Rhamnaceæ** (P. 20).

Climbing shrub : *leaves* palmate : flowers small ; *petals* falling off in a cap : *fruit* a berry. *Product* : fruit .. .. **11. Vitaceæ** (P. 20).

Trees : *flowers* polygamous, small ; *sepals*, *petals* and *stamens* usually 4 or 5 : fruit a drupe in **Mangifera** and **Spondias** and formed of the enlarged stalk in **Anacardium** in which the true fruit is nut-like. *Product* : fruit .. .. .. **12. Anacardiaceæ** (P. 23).

A soft wooded tree : *leaves* pinnately compound : *flowers* irregular, in large panicles : *calyx* cup-shaped with 5 lobes ; *corolla* of 5 unequal petals ; *stamens* delicate : fruit an elongate, enlarged capsule ; *seeds* with white, corky testa. *Products* : vegetables .. .. **13. Moringaceæ** (P. 27).

(*b*) *Petals* and *stamens* usually inserted on the calyx or on the top of the ovary when that is inferior.

Ovary superior (inferior in **Pyrus**)

Erect or climbing herbs or shrubs: *flowers* irregular; corolla papilionaceous; *stamens* 10, monadelphous or diadelphous: *fruit* a legume or pod. *Product*: beans or pulses .. **14. Leguminosæ** (P. 27).

Herbs, shrubs or trees: *stamens* indefinite: *fruit* a drupe in **Prunus**, a head of drupels in **Rubus**, of achenes scattered over an enlarged succulent receptacle in **Fragaria** and a pome in Pyrus. *Product*: fruit .. **15. Rosaceæ** (P. 48).

Ovary inferior.

A tree: *leaves* opposite, dotted with intramarginal veins: *flowers* 1 to 3, in the axils; *calyx* top-shaped: *fruit* an apple-like berry with many small, hard, seeds. *Product*: fruit .. **16. Myrtaceæ** (P. 50).

A spiny shrub: *flowers* scarlet: *fruit* a berry with hard rind; *seeds* many, each with a pulpy outer coat which is the part eaten. *Product*: fruit .. **17. Lythraceæ** (P. 52).

Herbs: *calyx* tubular of 2 to 5 valvate lobes, united to the very long inferior ovary; petals 2 to 6 inserted on the calyx; *stamens* as many or double, similarly inserted; *fruit* a capsule or berry. *Product*: fruit .. .. **18. Onagraceæ** (P. 53).

A palm-like small tree, with large deeply palmate leaves: *male* and *female flowers* usually on separate plants: *fruit* a large, hollow, melon-like berry bearing seeds over its inner surface. *Product*: fruits. **19. Caricaceæ** (P. 54).

Climbing by tendrils: *male* and *female flowers* on the same or separate *plants*; *calyx* combined with the ovary; *corolla* often with the petals united: *fruit* large berry-like, sometimes dehiscent when quite ripe. *Products*: vegetables and fruits .. .. .. **20. Cucurbitaceæ** (P. 55).

Herbs : *leaves* deeply divided : *flowers* small, in umbels ; *stamens* and *petals* on the top of the ovary : *fruit* dehiscing into two equal seed like carpels when ripe. *Products* : vegetables, spices .. .. **21. Umbelliferæ** (P. 63).

2. Gamopetalæ.

Ovary inferior.

Herbs : *flowers* in involucrate heads : *fruits* of seed-like carpels. *Products* : vegetable, oil seeds and dye .. **22. Compositæ** (P. 66).

Ovary superior.

A tree : *flowers* small, axillary ; outer parts red woolly : *fruit* an ellipsoid milky berry with a brown rind. *Product* : fruit .. .. **23. Sapotaceæ** (P. 69).

A creeping plant with tuberous roots : *corolla* trumpet-shaped. *Product* : vegetables .. .. .. **24. Convolvulaceæ** (P. 69).

Herbs : *flowers* often extra axillary, regular, rotate or funnel shaped ; *anthers* connivent or free : *fruit* an indehiscent fleshy or dry berry or capsular. *Products* : vegetables, condiments, fruits narcotic. .. **25. Solanaceæ** (P. 70).

Herb : *leaves* usually lobed or divided : *flowers* showy, irregular ; *corolla* tubular, ventricose : *capsule* tetragonous, oblong, many-seeded. *Product* : oil seed .. .. .. **26. Pedaliaceæ** (P. 78).

Herb : *leaves* simple, strong smelling : *stems* square : *flowers* irregular, small, in whorls ; *calyx* persistent, 4 or 5-cleft ; *corolla* tubular, bilabiate, ringent ; *stamens* 4, didynamous, epipetalous ; *stigma* bifid : *fruit* of 4 small seed-like nuts at the bottom of the calyx tube. *Product* : condiment .. .. **27. Labiatæ** (P. 79).

3. Apetalæ.

Herbs: *flowers* small, in clusters or panicles; *sepals* dry; *stamens* 5 or 2 or 3: *fruit* a compressed utricle, indehiscent or circumscissile, one-seeded. *Products*: leaves as vegetable; seed as grain .. **28. Amaranthaceæ** (P. 80).

Herbs: *sepals* 3 to 5, free or connate; *stamens* usually 5: *fruit* usually a utricle enclosed in the often enlarged fleshy calyx. *Products*: vegetables .. **29. Chenopodiaceæ** (P. 81).

Flowers pink, small, showy; *calyx* 5-partite; *stamens* 8: *nut* small, three-cornered; *albumen* of seed floury. *Product*: nut used as grain .. **30. Polygonaceæ** (P. 83).

Climbers, rooting at the joints: *leaves* often unequal-sided: *flowers* minute, male and female on separate plants, in catkin-like spikes; *perianth* absent; *stamens* usually 1 to 4: *berry* small, ovoid or globose; *seed* usually globose. *Products*: as condiments and in medicine .. **31. Piperaceæ** (P. 83).

Shrubs or trees: *flowers* unisexual; *calyx* with 2 or 5 free or united sepals; *petals* 5: *fruit* a 1 to 5-celled drupe or a capsule with 3 cocci; *seeds* single in each cell. *Products*: fruits, oil seed .. .. **32. Euphorbiaceæ** (P. 84).

Herbs, shrubs or trees: *flowers* usually minute unisexual; *stamens* as many as or fewer than the perianth segments; *carpels* 1-seeded, simple, free or combined into a confluent mass with the receptacles. *Products*: fruits .. .. **33. Urticaceæ** (P. 86).

B. MONOCOTYLEDONS

Stems without separable wood and bark: *leaves* with parallel venation (netted in Dioscereaceæ and Araceæ).

Ovary inferior.

Rhizomatous herbs: *leaves* membranous, fragrant: *flowers* irregular; *perianth*

biseriate; *stamen* 1, perfect: *fruit* a capsule or soft and fleshy. *Products*: condiments .. .. .. **34. Zingiberaceæ** (P. 88).

Large herbs with a false stem composed of convolute leaf sheaths: *leaves* large, oval, with a stout midrib and parallel lateral veins: *flowers* arranged in cymose or racemose inflorescences with large leathery brightly coloured bracts; *periath* 3 and 3, free or united; *stamens* 3 and 2 and a staminode; *ovary* inferior, of three carpels: *fruit* a succulent berry. *Product*: leaves, fruits .. .. **35. Musacæ** (P. 90).

Stemless plant with tufts or spiny serrate rather rigid leaves: *fruit* formed of the whole inflorescence combined into a fleshy syncarp. *Product*: fruit .. .. **36. Bromeliceæ** (P. 92).

Perennial herbs, with thick, radical, rosulate leaves: *inflorescence* large, candelabra-like. *Products*: fibres .. .. **37. Amaryllidaceæ** (P. 92).

Ovary superior.

Twining herbs with large subterranean tubers: *leaves* reticulate venined: *flowers* unisexual, small: *fruits* three-winged capsules. *Products*: vegetables .. .. **38. Dioscoreaceæ** (P. 96).

Bulbous herbs: *flowers* bisexual, umbellate; *sepals* 6, biseriate; *stamens* 6: *fruit* a 3-celled capsule. *Products*: vegetables .. **39. Liliaceaæ** (P. 98).

Trees with terminal tufts of large fronds: *flowers* uni-orbisexual, enclosed in one or more spathes; *perianth* of 6 biseriate segments: *fruit* a 1-3-celled drupe. *Products*: fruit, fibre, sugar, oil, etc. .. **40. Palmaceæ** (P. 98).

Stemless herbs with short corms: *leaves* simple or compound with reticulated venation: *flowers* unisexual on a spadix which is enclosed in a spathe. *Products*: vegetables .. .. .. **41. Araceæ** (P. 102).

Herbs with hollow or solid jointed culms : the ultimate divisions of the inflorescence, called spikelets consisting of bracts, the glumes and pales enclosing the lodicules, *stamens* and *pistils* of the true flowers : *fruit* a seed-like grain ; *embryo* small at the base of the seed on its exterior. *Products* : grain, sugar, fodder .. .. **42. Gramineæ** (P. 103).

FIELD, GARDEN, AND ORCHARD CROPS OF THE BOMBAY PRESIDENCY

1. ANONACEÆ

Small trees : *leaves* alternate, exstipulate : *flowers* bisexual, solitary or in small clusters, terminal or leaf-opposed ; *sepals* 3, small, valvate, slightly cohering or free ; *petals* hypogynous, 3 or 6, valvate, inner, when present minute, the exterior fleshy and concave at base ; *stamens* numerous, in many series on a thick torus ; top of *connective* ovoid ; *filaments* none ; *carpels* many, almost connate, when ripe cohering into an ovoid or globose many-seeded fruit ; *ovule* solitary, erect : *seeds* embedded in an edible pulp.

1. ANONA, L.

Characters as above.

Fruit tubercled, outer skin tender .. .. 1. **A. squamosa.**

Fruit smooth, slightly areolate, outer skin rather tough .. .. 2. **A. reticulata.**

1. **Anona squamosa,** L. Custard apple or sweet sop of America. **Vern.** Sitaphal (H, M, K) * ; Anusa (G). * A shrub or small tree, evergreen in moist situations and deciduous during the latter part of the hot weather in dry places : *leaves* membranous, oblong-lanceolate, slightly hairy and glaucous on the under-surface, foetid when bruised : *flowers* green with a yellow suffusion, shortly stalked, solitary; leaf-opposed or in clusters of 2 to 4 on extra axillary branchlets ; *pedicels* short, bracteate, becoming thick and woody in fruit ; *sepals* small, triangular, hairy ; *petals* hairy on both surfaces, one inch long, the inner circle very minute or altogether wanting : *fruit* globose, 2 to 4 inches in diameter, green, the channels dividing the areoles on the surface white or creamy yellow ; *pulp* white or creamy, of the consistence of soft butter ; *seeds* oblong, brownish black.

Flowers appear in May, June or at the beginning of the rains. Fruits ripen at the end of the rains.

A small tree, largely cultivated, but often seen naturalised throughout the country. In the latter condition it seldom produces good fruit. There seem to be two distinct varieties, the superior with creamy coloured channels on the surface and the same coloured pulp ; the inferior with white channels and pulp. The bruised leaves are used for destroying worms bred in sores.

2. **Anona reticulata,** L. Bullock's heart or custard-apple of America. **Vern.** Ramphal (M, K, G, S). A small tree, of more spreading habit than the last : *branches* woolly when young, becoming

*H Hindustani ; M Marathi ; K Kanarese ; G Gujarati ; S Sindhi.

smooth with age : *leaves* larger and longer than in the last, oblong-lanceolate, under-surface slightly hairy : *flowers* greenish in clusters of 2 to 4 ; *stalks* short, becoming longer, thick, and woody in fruit ; *sepals* small, woolly, ovate ; external *petals* $1\frac{1}{4}$ inch long, woolly on both surfaces, internal minute : *fruit* 4 to 6 inches in diameter, almost heart-shaped, yellowish with a muddy tinge when ripe ; *areoles* pentagonal, not very distinct ; *pulp* white, denser, and more acid than in A. SQUAMOSA ; *seeds* black.

This species is not cultivated to the same extent as the last and it does not have the same tendency to disseminate itself and become naturalised.

A third species, **A. muricata, Vern.** Mamphal or Mamaphal (M), the Sour sop of America, is occasionally grown in large gardens. The tubercles are produced into fairly strong spines and the pulp is stringy and intensely acid.

A fourth species, **A. cherimola,** Mill., the cherimoya, **Vern.** Marutiphal (M) or Hanamphala (K), is found to be as hardy as custard-apple and is recommended for cultivation. The fruit is ovate, narrow at the apex and broad at the base. It is distinguished from its allies by the presence on the skin of finger-print areoles.

2. PAPAVERACEÆ

Annual herbs with milky juice, glabrous and glaucous : *leaves* radical and alternate, amplexicaul, lobed : *flowers* showy, regular hermaphrodite, usually nodding in bud ; *sepals* 2, hypogynous, imbricate, very caducous ; *petals* 4, biseriate, caducous ; *stamens* numerous, hypogynous ; *ovary* 1-celled, globose ; *placentas* parietal ; *ovules* numerous ; *style* absent ; *stigmas* discoid, with radiating lobes opposite to the placentas which project into the cell : *fruit* a globose capsule, opening by short valves below the persistent stigmas ; *seeds* small, pitted, white or black.

1. PAPAVER, L.

As above.

1. **Papaver somniferum,** L. OPIUM POPPY. **Vern.** Afim (H) ; Afu (M) ; Afimu (K). 2 to 4 ft. high : *leaves* oblong, with dentate lobes : *flowers* white, purple, or scarlet, large : *capsule* 1 inch in diameter ; *seeds* very numerous, white or black.

Cultivated as a cold weather crop only in the Baroda State. Opium is obtained from the capsule, and the seeds, which are altogether destitute of any narcotic principle, are largely used in confectionery.

3. CRUCIFERÆ

Herbs with watery, often acrid juice : *leaves* radical or alternate, exstipulate : *flowers* usually racemose or corymbose ; *sepals* 4, free, imbricate, the two lateral often saccate at base ; *petals* 4, placed crosswise (cruciform), hypogynous, imbricate ; *stamens* hypogynous, 6, in two

series, the two outer opposite the lateral sepals, the four inner longer in opposite pairs (*stamens* tetradynamous) ; *disk* with usually four glands opposite the sepals ; *ovary* 2-celled by a placental membrane, or 1-celled or with superimposed cellules ; *ovules* usually many on 1 or 2 parietal placentas ; *style* short and persistent or altogether absent ; *stigma* simple or 2-lobed : *fruit* a long or short 2-celled, 2-valved pod (siliqua or silicula) ; *valves* dehiscent and leaving the seeds on the persistent placentas (replum) or indehiscent or of superimposed one-seeded joints ; *seeds* small, exalbuminous, *cotyledons* large, *radicle* turned up on the back of one cotyledon (incumbent) or facing the edges (accumbent).

A.	*Fruits* dehiscent, narrow, and long, usually bearing seeds throughout their length : *sepals* not pouched at base—	
	(*a*) *Fruits* cylindric ; *seeds* globose, biseriate : *flowers* white	1. **Nasturtium.**
	(*b*) *Fruits* cylindric, with a cylindric, seedless beak projecting beyond the valves ; *seeds* uniseriate : *flowers* yellow ..	2. **Brassica.**
	(*c*) *Fruits* turgid, with a seedless flattened beak ; *seeds* biseriate : *flowers* white or yellow	3. **Eruca.**
	(*d*) *Fruits* short, broad ; *valves* compressed laterally ; *seeds* solitary in each cell : *sepals* not pouched at base ; *corolla* white	4. **Lepidium.**
B.	*Fruits* not dehiscent, elongate, terete : *sepals* pouched at base ; *flowers* white with purple veins	5. **Raphanus.**

1. NASTURTIUM, R. Br.

An aquatic herb, with procumbent, rooting stems, growing in clear running water : *leaves* pinnate : *flowers* small, in short racemes : *fruit* up to 1 inch long ; *seeds* minute, red.

1. **Nasturtium officinale,** R. Br. WATER CRESS.

An introduction from Europe, growing in water-courses near towns in the Deccan. The plant extends from temperate Europe and Asia to the north-western frontier of India.

2. BASSICA, L.

Smooth or hairy, annual or perennial herbs : *leaves* pinnatifid or lyrate, upper often entire : *flowers* yellow, in racemes ; lateral *sepals* usually pouched at base ; *petals* clawed : *fruits* elongate ; *seeds* globose or ovoid, *cotyledons* incumbent.

Pods ½ inch long, pressed closely to the axis	1. **Brassica nigra.**
Pods ½ inch long, spreading, hairy ..	2. **Brassica alba.**

Pods 3 inches long, usually 2-valved and 2-celled.	3. **Brassica campestris** *var.* **sarson.**
With a swollen root	4. **Brassica campestris** *var.* **rapa.**
Pods 2½ inches long	5. **Brassica juncea.**
The cabbage and its varieties	6. **Brassica oleracea.**

1. **Brassica nigra,** Koch. BLACK MUSTARD. **Vern.** Rai (H); Mohari (M); Sasivi (K); Rai (G). A hispid annual, 2 to 3 ft. high: *leaves* petioled, lower lyrate, upper entire, recemes moderately long: *pods* ½ inch long, erect, pressed closely to the axis.

Cultivated in the fields during the cold season. It is the "Black Mustard" of commerce.

2. **Brassica alba,** Rabenh. WHITE MUSTARD. A hairy plant with spreading fruits, which are also hairy.

Often cultivated by Europeans to be used as a dry salad with cress. It is only eaten in its very young state. The seeds are also used in the preparation of the condiment called "Mustard."

3. **Brassica campestris** *var.* **sarson.** A tall annual, cultivated in fields: *leaves* large, glaucous beneath: *flowers* about 1 inch in diameter: *fruits* up to 3 inches long, usually 2-valved and 2-celled, sometimes spuriously 3 to 4-valved; *seeds* numerous, yellow or brown. Var. **Gaj sareh** has white seeds, and Var. **Karo sareh** has black seeds and hairy leaves.

Cultivated in fields during the cold season. The oil yielded by the seeds on pressure is largely used in cookery and is also often burnt in lamps.

4. **Brassica campestris** *var.* **rapa,** L., the TURNIP, **Vern.** shalgam, is often cultivated in gardens for its large tuber-like roots.

5. **Brassica juncea,** Coss. VERN. Rai (H); Mohari (M). An annual, cultivated in fields, varying in height: *stems* tinged with purple: *leaves* pinnatifid or sinuate, lyrate: *flowers* about ½ inch in diameter: *pods* up to 2½ inches long; *seeds* many, brown.

A cold weather crop. The oil from the seeds is used in cookery.

6. **Brassica oleracea,** L. **Vern.** Kobi (H); Kobigaddi (M); Kobi (K); Pangoli (G).

A large number of varieties of this, the European cabbage, are grown in gardens, such as **acephala,** Scotch kail; borecole; **bullata,** the savoy cabbage; **gemmifera,** Brussels sprouts; **capitata,** red and white cabbage (Drum head and pointed head cabbage); **caulocarpa,** the knolkhol or kholrabi; **botrytis,** the cauliflower.

Diseases and pests of the cabbage.—Black-rot of cabbage is an extremely destructive disease which is caused by *Pseudomonas campestris.* The host may be affected at any time during its growth from the youngest seedling until the time of harvesting. The organism lives on the seed-coat and in the refuse left in the field. In order to obtain clean seed, it

should be soaked in a 1 to 1000 solution of corrosive sublimate for 20 minutes and then washed in water. Also, rotation should be practised and well-drained soil used.

The cabbage seedlings are attacked in the very early stages by the mustard sawfly and the Diamond moth. These pests nibble the leaves and thus impair or destroy the vitality of the seedlings making them unserviceable for transplanting. The remedy is to spray them with tobacco decoction or dust them with tobacco powder. Sometimes the cabbage plants bolt, *i.e.*, rush up into a long vegetative stem, and refuse to form heads.

3. ERUCA, Mill.

Annual or biennial erect branching herb : *stems* hispid with reflexed hairs : *leaves* petioled, lyrate pinnatifid, sinuate, dentate, dark-green or glaucous : *flowers* rather large, greenish-yellow veined with purple ; *sepals* oblong, lateral, gibbous at the base ; *petals* obovate : *pod* turgid, closely appressed to the stem with an ensiform seedless beak ; *seeds* numerous, biseriate, globose.

1. **Eruca sativa,** Mill. **Vern.** Safed sarson (H) ; Jambo taranina (S). Upwards of 2 ft. in height : *calyx* quadrangular, twice as long as pedicels ; *sepals* $\frac{3}{8}$ inch long, often tipped with hairs ; *petals* $\frac{5}{8}$ inch long : *pod* 1 inch long, *beak* flattened, 3-nerved ; *seeds* reddish brown.

Pollination. Experiments by bagging have shown that seed-setting is the result of cross-fertilization, self-fertilization being very rare.

Cultivated in Sind.

4. LEPIDIUM, L.

An herb : radical *leaves* long petioled, bipinnatisect, cauline, entire : *flowers* white, small, in long racemes : *pods* orbicular ovate, deeply notched.

1. **Lepidium sativum,** L. Cress. **Vern.** Halim or Akalam (H) ; Alvi or Allipija (K) ; Asalio (G) ; Ahreo (S).

A small, smooth annual, generally cultivated in gardens. The leaves are used by Europeans in salads and the seeds are used for medical purposes.

5. RAPHANUS, L.

In India an annual herb : *leaves* lyrate, loosely covered with rough hairs : *flowers* in long racemes, white or pink with purple veins ; lateral *sepals* saccate at the base : *fruits* terete, indehiscent, continuous or constricted, with a long tapering beak ; *seeds* globose, often separated from each other by pith.

1. **Raphanus sativus,** L. Radish. **Vern.** Mula (M) ; Mulangi (K) ; Muri (G).

Commonly grown in vegetable gardens, the root of the form usually grown in India is white, sometimes attaining a great girth and length. The European forms are smaller generally purple in colour and globose or fusiform in shape.

Var. **caudatus,** Alef. **Vern.** Mogari (M & G).

This variety is grown in Gujarat for its dark-red pods, which often attain a length of 2 feet or more. These are used as a vegetable.

4. PORTULACACEÆ

Herbs, glabrous and succulent : *leaves* opposite or alternate, entire, fleshy : *inflorescence* various, terminal ; *flowers* regular, hermaphrodite ; *sepals* 2 ; *petals* 4 or 5, hypogynous or perigynous, imbricate, entire ; *stamens* 4 to many, inserted with and adnate to the petals at base ; *ovary* free or semi-inferior, 1-celled : *capsule* membranous or crustaceous ; *seeds* small, many.

1. PORTULACA, L.

Diffuse fleshy herb : *flowers* yellow, terminal, surrounded by a whorl of leaves ; *stamens* perigynous ; *ovary* half adnate.

1. **Portulaca oleracea,** L. Purslane. **Vern.** Ghol (G) ; Ghol bhaji or Moti-ghol (M). Prostrate plant spreading to a distance of 2 ft. or more from its root stock, smooth fleshy : *leaves* alternate, sessile, flat oblong, cuneate : *flowers* sessile, in clusters ; *petals* 5 ; *stamens* 8—12 ; *style* about 5-parted.

This is not actually cultivated or planted. It is a very common weed in irrigated gardens and fields, throughout the Presidency from Sind to Kanara, especially in slightly salty or wet soils. Leaves are extensively used as a potherb or " bhaji " by all kinds of farm labourers.

5. MALVACEÆ

Herbs and shrubs, often with stellate hairs : *leaves* alternate, palmate, often lobed, stipulate : *flowers* regular, bisexual, cymose, axillary or terminal, often solitary ; *involucral bracts* (*epicalyx*) 2 or more, connate or free ; *calyx* gamosepalous ; *limb* lobed or entire ; *corolla* polypetalous, of 5 petals adnate to the base of the staminal tube, contorted ; *stamens* indefinite, connate into a tube below, above divided into numerous anther-bearing filaments ; *anthers* 1-celled, dehiscing longitudinally ; *ovary* syncarpous, many-celled ; branches of the *style* equal in number to the carpels ; *ovules* on axile placentas : *fruits* capsular and loculicidal ; *seeds* with mucilaginous albumen, *cotyledons* crumpled.

1. *Involucral bracts* 5 or more ; branches of the *style* spreading : *seeds* kidney-shaped or globose .. .. .. 1. **Hibiscus.**
2. Involucral bracts 3, large ; branches of the *style* coherent : *seeds* obvoid .. .. 2. **Gossypium.**

1. HIBISCUS, L.

Bushy herbs, armed or unarmed : upper *leaves* palmately lobed : *peduncles* axillary ; *involucral bracts* 7 to 12, narrow, shorter than or equalling the calyx ; *calyx* gamosepalous, equally lobed or spathaceous ;

corolla yellow or purple, with a dark eye ; *staminal tube* truncate or 5-toothed at the apex ; *filaments* numerous ; *ovary* 5-celled ; *ovules* 3 or more in each cell ; *styles* 5, free towards apex ; *stigmas* capitate : *capsule* loculicidally 5-valved ; *seeds* smooth or with minute stellate hairs.

Involucral bracts free, linear, shorter than the calyx ; *calyx lobes* long, pointed with an obovate gland on the back at base ..	1. **H. cannabinus.**
Involucral bracts adnate to the calyx tube ; *calyx* accrescent, thick, fleshy, purple ..	2. **H. sabdariffa.**
Involucral bracts linear ; *calyx* elongate, spathaceous : *capsule* elongate ..	3. **H. esculentus.**

1. **Hibiscus cannabinus,** L. **Vern.** Ambadi (M) ; Pundi (K) ; Ambadi (G) ; Sujiado (S). An annual or perennial prickly shrub : *stems* glabrous or prickly : lower *leaves* simply cordate, upper deeply palmately 3 to 5-lobed, lobes narrow, the margins of all leaves serrate, midnerves with a gland beneath near the base ; *petioles* prickly, the lower longer than the blades ; *stipules* linear, subulate : *peduncles* axillary, very short ; *bracts* 7-10, $\frac{3}{8}$ inch long, linear, often with prickly margins, shorter than the calyx ; *calyx* accrescent in fruit, 1 inch long ; *sepals* connate below the middle ; *lobes* long, lanceolate-acute ; *midribs* thick, and with an oblong-obovate gland at the base of each lobe ; *corolla* spreading, yellow with a crimson eye : *capsule* globose, pointed, beaked, very hairy ; *seeds* large, brown, dotted with minute stellate scales.

Varieties. Howard and Howard (7) have described five varieties which can be divided into two classes : one with entire leaves and the other with 5-lobed leaves, each of these again being sub-divisible into green and red-stemmed and green and purple-stemmed forms. In the Bombay Presidency, there is only one variety (var. **vulgaris**) which has green stems and divided leaves. Entire leaves are often borne on the main stems. In Gujarat, however, two forms are known : one is Bodia (smooth), and the other is Khajuria (prickly).

Pollination. When the flowers open, the stigmas are flush with the mouth of the staminal column and anthers not yet burst. Soon after day-break, the anthers burst and are covered with the large echinate pollen, the stigmas still remaining flush with the column. After this, on account of the cessation of the turgidity of the filaments, the burst anthers fall back upon the column and at this stage the pollen grains are rarely seen on the stigmas. Sometimes the styles bend outwards and carry the stigmas on to the pollen, thus effecting self-pollination. Frequently no pollen is seen on the stigmas when the flowers begin to close about midday. On examination, closed flowers are found to be pollinated. This is brought about by the twisting of the corollas, which effects self-pollination. Crossing either by insects or artificially by hand is possible from the time the styles begin to carry the stigmas beyond the opening of the column to the closing of the flowers. Natural cross-pollination is fairly common when the various types are grown together and allowed to flower freely.

Largely cultivated throughout the rains as a fibre and leafy vegetable plant, usually grown with other crops, or sometimes used as a border to the fields.

2. **Hibiscus sabdariffa,** L. Rozelle. **Vern.** Lal Ambadi (M); Patwa (H); Pundibija (K). Annual or perennial erect shrub with reddish smooth stems and branches: lower *leaves* usually undivided, upper palmately 3 to 5-lobed, all wedge-shaped at the base and glandular at the base of the mid-nerve beneath, margins serrate; *petioles* 2 inches long, reddish: *peduncles* axillary, very short, stout, jointed and continuous with the pedicels; *bracteoles* lanceolate, 8-10, adnate to the base of and shorter than the calyx; *calyx* accrescent dark purple and fleshy with 3-nerved lanceolate lobes; *corolla* 2½ inches in diameter, purple with a darker centre: *capsule* ovoid, pointed, villous, shorter than the calyx; *seeds* large, reniform, covered with minute, stout, stellate hairs.

Varieties. Howard and Howard (7) have divided this into four varieties distinguished by the color of stems, leaves, stipules, sepals and petals. The variety called *Ruber* is the one cultivated in the Bombay Presidency.

Pollination. Flowers open late in the morning and close at midday remaining open for not more than three hours. Stigmas always remain flush with the column not growing up at any time. Filaments are short and anthers burst round the opening of the column. Self-pollination is favoured by these arrangements and the completion of the process is brought about by the closing of the flowers. Natural cross-fertilization does not appear to be common. Self-pollination is the rule.

Cultivated in gardens throughout the Presidency for the sake of the fleshy capsule and calyx from which an acid jelly is prepared. A strong silky fibre is extracted from the stems.

3. **Hibiscus esculentus,** L. Lady's finger. Ockro. **Vern.** Bhendi (S, M); Bhende Kai (K); Binda (G). An erect annual, not prickly but rough with brittle hairs: *leaves* cordate, palmately 3 to 5-lobed; *lobes* broad, coarsely toothed; *petiole* long; stipules subulate: *peduncles* short and stout; *bracteoles* 8-10, linear subulate, equalling the calyx, deciduous; *calyx* spathaceous, deciduous; *corolla* yellow, with a purple centre: *capsules* 6 to 10 inches long, pyramidal oblong, acute, smooth or hairy; *seeds* round, striate, hairy.

Two varieties are recognised: early and late. In the former, the capsules are thin, long and smooth, and in the latter, they are thick, short and prickly. In the foreign kinds the fruits have no ribs.

Cultivated throughout the Presidency and throughout the year as a garden crop. The unripe very mucilaginous capsules form a well-known vegetable; they are also pickled, and the seeds are also eaten. The strong, white silky fibre has been found very suitable for the manufacture of paper. The capsules and seeds are also used medicinally as a demulcent.

2. GOSSYPIUM, L.

Cotton. Shrubs : *branches* ascending or spreading, becoming successively shorter upwards, all parts of the plants, except the flowers, covered with partially deciduous hirsute simple and stellate hairs : *leaves* membranous or subcoriacious, palmi-nerved and usually palmi-lobed, accessory lobes often rising from or above the sinuses, the central nerve and usually the nerve on either side of it bearing a gland on the undersurface ; *stipules* falcate, entire or toothed : *inflorescence* in one-flowered cymes ; *peduncles* and *pedicels* short, trigonous ; *involucre* or *epicalyx* of three connate, broadly cordate bracteoles, subtending the calyx ; *calyx* gamosepalous, campanulate or cupular with an entire or irregularly toothed limb, and also with three glands at the base externally ; *corolla* of 5 contorted petals, dark purple, pink, yellow or white, with darker centres ; *staminal tube* antheriferous upwards ; *ovary* syncarpous, 3 to 4-celled : *capsule* or *boll* 3 to 4-celled, spherical or ovoid acuminate, dehiscence loculicidal ; *seed* with a hard testa and spiny hilum ; *testa* naked or covered with short down called fuzz, or velvet and longer, unicellular, twisted, white or tawny hairs known as cotton.

Branches. On the cotton plant two main types of branches are distinguishable : (*i*) Monopodia or vegetative branches. These are mostly found in the lower region of the plant ; they are straight growing, their axes elongate during growth and terminate in a growing point, and (*ii*) Sympodia or reproductive branches. These are found in the higher region of the plant ; they are zigzag and their axes of growth are terminated by a flower. Both of these types may be found on the main stem, or as secondary branches, or one upon the other.

The following is the classification of the cultivated cottons in the Bombay Presidency :—

A. **Rozi and Deo Kapas Group.**—All the branches ascending and thickly crowded, not drooping at their extremities : *leaves* with basal lobes and lateral folds in the sinuses : *bracteoles* entire or only slightly toothed on the margins and apex ; *flowers* small, dark purple, pink purple or yellow.

Whole plant green : *corolla* yellow	.. 1. **G. obtusifolium.**
Whole plant and *corolla* dark purple or red	.. 2. **G. arboreum.**

B. **Herbaceum Group.**—Bushes round headed or with the apex of the stem slightly prolonged and sparsely branched : all the *branches* usually long and spreading : *leaves* softly hairy, light green, lateral folds only in the sinuses : *bracteoles* round, uniformly gashed, usually spreading in fruit ; *flowers* yellow.

Valves of *bolls* reflexed so that the cotton is pendulous when ripe ..	.. 3. **G. herbaceum.**
Bolls large, not opening widely ..	.. 3. **G. herbaceum** *var.* **sakalia.**

C. **Bani Group.**—Lower branches long, slightly ascending, medium and upper sparse, short, more or less drooping, becoming successively

shorter, apex of simple stem much produced : *bracteoles* triangular entire or slightly toothed upwards; *petals* reflexed, yellow or white : *cotton* scanty and fine.

Flowers yellow .. .. 4. **G. indicum.**

D. **Jari and Varhadi Group.**—Sparsely branched plants, method of branching as in C : *leaves* dark green : *bracteoles* triangular, entire or slightly toothed upwards ; *petals* reflexed, yellow or white : *cotton* usually copious, short and extremely coarse.

Flowers yellow .. .. 5. **G. neglectum** *var.* **vera.**

Flowers white .. .. .. 5. **G. neglectum** *var.* **rosea.**

E. **Dharwar-American Group.**—

A cotton of American origin. Low rounded bushes : *leaves* simple to 5-lobed, usually 3-lobed ; *lobes* short, triangular, with straight margins : *bracteoles* rounded with caudate, acuminate teeth ; *flowers* light yellow, without a dark eye : *bolls* large, spherical .. .. .. 6. **G. hirsutum.**

F. **Kil Group.**—

Low plants : lower *branches* drooping, upper becoming successively shorter : *leaves* dark green, with narrow radiating lobes : *bracteoles* large, triangular, acuminate, entire, toothed only at apex, longer than flowers, reflexed in fruit ; *flowers* normally white : *bolls* usually large ; *cotton* white or drab .. 7. **G. cernuum.**

1. **Gossypium obtusifolium,** Roxb. **Vern.** Rozi or Jari (G). Attaining the height of 7 feet and upwards : *stems* robust, internodes short, all the branches acutely ascending and crowded ; *branches* dark red, with close, very short stellate hairs, mixed with longer, simple pilose hairs as are also the petioles and leaves : *leaves* small, 5-lobed ; *lobes* ovate, rather obtuse mucronate, sinus broad and narrow, with a small extra lobe or fold : *bracteoles* ovately triangular acute, teeth rather shallow, usually found towards the apex but sometimes occurring on the whole margin : *cotton* scanty, moderately fine and curly : *seeds* with a greenish grey velvet.

A perennial, growing for 6 or 7 years on the light soils of Northern Gujarat. It readily runs wild and in hedges assumes a climbing habit, the cotton turning yellow and short in staple. This species differs chiefly in colour from **G. arboreum.**

2. **Gossypium arboreum,** L. Indian Tree Cotton. **Vern.** Dev Kapas. Perennial, reaching 12 feet in height : *stems* robust, internodes short, all the branches acutely ascending : *branches* dark red, with close,

very short stellate hairs, as have also the petioles and leaves : *leaves* 5-lobed ; *lobes* narrowly oblong or ovate-oblong, obtuse mucronate, sinus broad, often with small accessory basal or lateral lobes : *bracteoles* ovately triangular acute, quite entire, 1 to 3-toothed at apex or with teeth extending throughout two-thirds of the margins ; *corolla* dark red : *bolls* brown, opening fully when ripe ; *cotton* scanty, moderately fine and curly ; *fuzz* greenish grey.

3. **Gossypium herbaceum,** L. Varying in height from 2 to 7 feet, basal branches long and spreading, medium and upper also long and spreading, drooping in fruit, younger parts covered with soft, white hairs : *leaves* rather membranous, yellowish green, cordate rotundate, palmately 3 to 5—or more—lobed ; *lobes* ovate obtuse or acute, basal lobes, when present, rise only from above the sinus : *bracteoles* spreading in fruit, round, toothed nearly over the whole margin : *capsules* almost spherical or ovate ; *cotton* fine, often reaching 1 inch in staple.—Var. **sakalia** differs from the type in the following particulars : *bolls* spherical, with broad valves, spliting so slightly when ripe that the cotton does not emerge.

The typical examples of **G. herbaceum** are *Lalio* of Kathiawar, *Broach, Ghogari, Lalio* and *Kanvi* of Gujarat, and *Kumpta* or *Javarihatti* of the Southern Maratha Country ; and of Var. **sakalia,** *Wagad* and *Sakalio* in Gujarat.

4. **Gossypium indicum,** Lam. Hinganghat Cotton. **Vern.** Bani (M). Stems attaining a height of 8 feet, simple, tapering gradually from base to apex : *leaves* varying from entire to 3 or occasionally 5-lobed ; *lobes* broadly ovate, sinuses broad : *bracteoles* ovate pointed, entire or few-toothed at the apex: *cotton* scanty ; *staple* silky, long.

This species once formed the bulk of the fine cotton of Barsi in the Sholapur District but, as in other parts of India, it is more or less replaced there by more productive but coarser sorts.

5. **Gossypium neglectum,** Tod., var. **vera. Vern.** Varhadi (M). Plants varying in height from 3 to 7 and more feet : *stems* tapering from base to apex as in the last : *leaves* palmate or palmatipartite 3 to 5 or more-lobed ; *lobes* oblong lanceolate, ovate acute or subobtuse sinuses broader rising up into small accessory lobes, base shallow cordate : *bracteoles* deeply cordate, ovate acute, quite entire towards apex or sometimes toothed there : *bolls* ovate, obtusely pointed ; valves separating and recurved when ripe ; *cotton* harsh and copious, clinging more or less firmly to the seed ; *seed* covered by grey velvet.

Besides the typical form of the variety described above which is found in Khandesh and other Deccan Districts, there are several distinguishable sub-varieties.

The first sub-variety **malvensis,** differing in having the lobes of the leaves broader and the cotton of superior quality. In this Presidency this sub-variety seems to be confined to Sind.

The second sub-variety **Kathiawarensis,** confined to Kathiawar, in which the lower branches are larger and more ascending than in the type ; the lobes of the leaves are larger and more flaccid and the cotton is finer. It is known by the vernacular names of *Hirvani* and *Mathio* or *Moto Mathio.*

Var. **rosea.** N. R. Cotton of the Bombay Presidency. **Vern.** Varhadi (M).

This is separated from var. **vera** only by the white flowers. The cotton is even coarser and the proportion of cotton to seed is greater in the white than in the yellow flowered plants. White flowered plants come true to seed and are universally found mixed with yellow flowered plants. This variety has the same distribution therefore as the last and the sub-varieties are parallel, for instance, the **cutchica** differs only from the sub-variety **Kathiawariensis** of **vera** by the white flowers. The vernacular names in Kathiawar are identical.

A selected strain of this known as D6 is likely to find favour at Dharwar.

Sind-Deshi Cotton is of the **neglectum** type classed in the trade among the Bengals. Its ginning percentage is $33\frac{1}{3}$. It is a rough, early, prolific and bright cotton.

6. **Gossypium hirsutum,** L. Upland Georgian : Dharwar-American. From 2 to 4 feet high : lower *branches* erect, upper spreading, young parts white hairy : *leaves* subcoriaceous, dark green, drying red, varying much in shape, ovate or ovate cordate entire, cordate with 1-3 shallow lobes or palmately cordate with three shallow or very deep triangular or ovately triangular acute lobes which point forwards : *bracteoles* rounded, upper half of the margins with very long fine teeth ; *corolla* pale yellow, without any eye, fading red : *bolls* spherical or ovate ; *cotton* silky, long in staple.

This species, the Upland Georgian of America, is perfectly naturalised as an important field crop in the Southern Maratha Country.

7. **Gossypium cernuum,** Tod. General characters as in **Gossypium neglectum.** *Leaves* usually with very narrow radiating lobes : *bracteoles* ovate acute, quite entire towards apex or with 3 to 6 acunimate teeth ; dimensions in flower 1 to 2 inches long, $\frac{3}{4}$ to $1\frac{1}{4}$ inch broad ; *corolla* about $\frac{3}{4}$ inch longer than the bracteoles, white or pale yellow, with a dark eye dying pink ; *bracteoles* in fruit up to $2\frac{1}{2}$ inches long, slightly shorter or longer than the bolls : *bolls* ovate pointed, 3 to 4-celled, very distinctly black dotted.

It is represented by a series of forms in Assam, by an introduced variety in Sind and by another variety, perhaps also introduced, in the United Provinces. The Director of Agriculture, Assam, states that the Kil is grown in Garo Hills and probably also on the northern slopes of the Khassia hills. Its pods are very large, being sometimes as much as eight inches in length. The quality of the lint is harsh, only fit for mixing with wool. *Bor Kapah* and *Sora Kapah* are grown in the Mikir Hills and in the adjacent plains in Nowgong and Golaghat by the hill tribes (mostly

Mikirs). **Gossypium cernuum,** Tod, var. novo. **silhetensis** differs from the type only in having drab coloured cotton. It is represented by four forms from Assam, one introduced into Sind and one Chinese. The last may be one of the forms known as **G. Nanking,** Meyen.

The extra Indian distribution of **Gossypium cernuum,** Tod, is doubtful, but it is probably endemic in North Eastern India and China.

In addition to these cottons which are all more or less entitled to rank as natives of the country, there are several of the American tree cottons grown here and there in gardens. Any extension in their cultivation seems to result invariably in disaster.

The commonest form is the Kidney, Chain seed or Brazilian Cotton (**G. acuminatum**) which is recognised at once by its large palmatipartite leaves, large stipules and flowers and long pointed bolls bearing coherent seeds.

The Bourbon Cotton resembles a large form of **G. hirsutum,** but its leaves are small and not so hairy, and the flowers have dark eyes.

Pollination. The stigma is receptive and pollen is liberated shortly after the flower opens from 8 a.m. onwards ; in half an hour self-pollination takes place. The slightest agitation is enough for pollen to fall on stigma. The growth of the pollen tube is rapid. Cross-fertilization takes place in nature under cultivated conditions as proved by the mixed state of unselected crops and by the growing of a type in one line among others and the study of the next generation. The extent of natural cross-fertilization is variously estimated and obviously depends on the variety, climate and pollinating agents.

Cropped area. The total area under cotton in the Bombay Presidency was 37,09,141 acres in 1922-23. East Khandesh possesses the largest share of the crop among all the districts, namely, 22 per cent. of the total area under cotton in the Presidency. Bijapur, Dharwar and West Khandesh follow with 17, 14, and 11 per cent. respectively. Ahmedabad, Ahmednagar, Belgaum and Broach contain from 6 to 7 per cent. while Surat, Sholapur and Nasik, about 3 per cent. each.

6. TILIACEÆ

Shrubs : *leaves* alternate, stipulate : *inflorescence* axillary, umbellately cymose ; *sepals* 5, valvate ; *petals* 5 ; *stamens* numerous, inserted on a turbinate torus ; *ovary* 2-4-celled ; *ovules* 2-many in each cell : *drupe* lobed, 1-celled.

1. GREWIA, L.

As above.

1. **Grewia asiatica,** L. **Vern.** Phalsa (H, S, G) ; Phalsi (M). Young parts stellately hairy : *leaves* broadly ovate or obliquely cordate or rounded at the base, often sublobate, softly tomentose, 5-6-nerved ; *stipules* nearly as long as the petioles, lanceolate falcate : *peduncles* axilllary, 2 to 4, longer than the petioles, 3-flowered ; *buds* clavate or cylindric, densely woolly, ribbed ; *bracts* lanceolate ; *sepals* linear oblong acute,

white woolly outside, yellowish inside ; *petals* yellow, about $\frac{2}{3}$ length of the sepals, oblong emarginate ; *basal gland* about $\frac{1}{3}$ the length of the petal, margin white villous : *drupe* indistinctly lobed, pilose, half inch in diameter, containing 1 or 2, 1-celled nuts.

Extensively cultivated throughout the Presidency but most so in Gujarat. The fruit is acid and a sherbat is made from it. It flowers during the cold weather and fruits ripen in the hot weather.

Firminger (6) says of this that it is " a coarse looking, unattractive shrub, somewhat resembling the Hazel in foliage, native of India and common in all parts of the country. The fruit is a berry about the size of a pea with a stone in the centre, sour and uneatable, but a sherbat made from it is considered agreeable by some."

7. LINACEÆ

Smooth, annual herb : *stems* slender, corymbosely branched : *leaves* narrow, alternate : *inflorescence* a corymbose panicle ; *flowers* regular, bisexual, blue, or white ; *sepals* 5, free, imbricate, the two outer elliptic acuminate with ciliate margins, the three inner broader, with ciliate margins, all 3-nerved ; *petals* 5, fugacious, imbricate ; *stamens* 5, connate at the base ; *ovary* 5-celled, the cells 2-seeded ; *styles* free : *capsules* scarcely exceeding the sepals, mucronate ; *seeds* compressed, dark brown shining.

1. LINUM, L.

As above.

1. **Linum usitatissimum,** L. Flax. **Vern.** *Javas* (M) ; Agase (K) ; Alsi (G, H). Characters as above : *plants* 2 to 4 feet high : *leaves* linear or lanceolate, 3-nerved : *flowers* 1 inch in diameter.

Classification of Linseed. In the Bombay Presidency only two types are known : white flowered and blue flowered. Howard and Abdur Rahman (8) have divided all the Indian forms into 26 varieties which are sub-divided altogether into 123 types. The basis of the classification is the colour of seeds, flowers, filaments, styles and anthers.

Pollination. Just about the time the flowers are fully open, anthers close in on the stigmas effecting self-pollination. A little later, the burst anthers fall together forming a cap over the stigmas thus making self-pollination a certainty. The twisting of the stigmas also contributes to self-pollination. Occasional cross-pollination is brought about by the visits of small bees. Experimental evidence is forthcoming to show that natural crossing is more common than would be supposed from a study of the flower.

A rabi crop grown in India for the oil in the seeds and not for the fibre from the inner bark which constitutes the flax of commerce utilized for making linen cloth.

Area. The total area under this crop is 2,65,429 acres, and it takes the fifth place among the oil seeds in the Bombay Presidency. It is sown in the rabi season in deep moisture-holding lands. It is generally grown

alone and is the sole crop of the year. About 42 per cent. of the total area is claimed by Bijapur. Nasik, Dharwar and Sholapur together make up about 40 per cent., while the remaining 18 per cent. of the area is found in other districts, except in the Konkan and in Gujarat where no linseed is grown.

The seed contains from 37 to 44 per cent. of oil and yields about 32 to 38 per cent. in the country oil press.

8. GERANIACEÆ

Small trees : *leaves* exstipulate, alternate, unequally pinnate : *flowers* regular, in short panicled cymes ; *sepals* 5, imbricate ; *petals* 5, contorted ; *stamens* 10, united at the base ; *ovary* 5-lobed, 5-celled ; *styles* 5 ; *stigmas* capitate ; *ovules* many in each cell : *fruit* an oblong, 5-lobed berry ; *seeds* with or without an aril.

1. AVERRHOA, L.

As above.

Leaflets 2-5 pairs : *fruit* acutely angled ; *seeds* arillate .. .. .. 1. **A. Carambola.**

1. **Averrhoa Carambola,** L. **Vern.** Kumrak (M, G, H, K). A small tree : *leaflets* ovate oblong acuminate, entire, glaucous and smooth beneath, base oblique acute : *sepals* smooth ; *petals* white and purple : *fruit* yellow.

Cultivated throughout the Presidency. Flowers appear during the rains and fruits during the cold weather.

Firminger (6) has the following remarks on this species. " The fruit is remarkably handsome of the size of a lemon, deeply ribbed or winged, when perfectly ripe semi-transparent and of a fine rich amber colour. Previous to becoming quite ripe it possesses a flavour somewhat between that of sorrel and a green gooseberry. When well ripened, it has a strong and agreeable scent, as nearly as possible like that of the quince, as well as a very fine and peculair flavour. It has however even then a degree of acidity which renders it hardly fit to be eaten raw. It does not bear cooking well, as it then becomes tough and horny ; but when the tough part of the fruit is removed the pulp affords a very delicious jelly." He also describes a variety differing by bearing a fruit smaller by about a half, when ripe, of deep green colour and not nearly so handsome, without the acidity of the ordinary kind and also entirely without its fine flavour.

The native country of this species is unknown.

9. RUTACEÆ

Trees or shrubs abounding in pellucid glands filled with essential oil : *leaves* compound, exstipulate : *flowers* regular, usually bisexual, in axillary or terminal cymes or panicles ; *calyx* of 4 to 5 lobes or sepals ; *petals* 4 to

5, hypogynous, valvate, or imbricate ; *stamens* 4 to 5, or 8 to 10, rarely more ; *filaments* usually free ; *disk* conspicuous within the stamens ; *ovary* of 4 to 5 or more connate carpels ; *ovules* many in each cell : *fruit* a berry or drupe ; *seeds* solitary or paired in the cells.

Leaves unifoliolate : *petals* white or pink ; *stamens* 20 to 60, variously connate : *berry* a hesperidium	1. **Citrus.**
Leaves imparipinnate : *flowers* dull red ; *stamens* 10 to 12 : *fruit* globose, with a hard rind and pulpy within	2. **Feronia.**

1. CITRUS, L.

Small trees : *leaves* unifoliolate ; *petioles* often winged ; *blades* persistent, coriaceous, entire or crenulate : *flowers* sweet-scented, solitary fascicled or in small cymes ; *calyx* cup-shaped, toothed ; *petals* 4 to 8, linear-oblong, thick, imbricate ; *stamens* 20 to 60, variously connate ; *disk* large, cup-shaped ; *ovary*—many celled ; *style* thick, deciduous ; *stigma* capitate : *berry* globose or ovoid, many-celled, the epicarp and mesocarp fused into a fleshy rind and the endocarp forming tough membranous integuments to each flake or cell ; the edible *pulp* in which the seeds are embedded originating from the placentas ; *embryos* sometimes two or more in one seed. The fruit being peculiar to this genus is well known and is botanically distinguished as " HESPERIDIUM."

The following is a popular botanical account as given by Paranjpye (13) :—

1. The juice sacs in the fruit are easily separated from one another and do not adhere in one mass. The young shoots and leaves of the plant are hairy	**Citrus decumana.**
2. The juice sacs in the fruit are not easily separated from one another and adhere in one mass. The young shoots and leaves of the plant are not hairy.	
(*a*) The fruits are mammillate, that is to say, the stigma end is more or less distinctly produced	**Citrus medica.**
(*b*) The fruits are not mammillate, that is to say, the stigma end is flattened ..	**Citrus aurantium.**

Citrus decumana, the POMELO, **Vern.** Papnas (M) and Pampari (K), occurs in two forms, with white pulp and with red pulp. The fruit and leaves of the pomelo are the largest of all among the citrus fruits. The red variety generally fetches a better price than the white. An intermediate variety with pink flesh is occasionally found.

Citrus medica. CITRON. **Vern.** Mahalung (M) ; Bijoura or Turanj (G) ; Madalada hannu (K). The fruit of this variety is large, weighing up to three pounds, the skin warty and rough, and the rind very thick,

(sometimes more than an inch thick) with a carrot-like consistency. The pulp is somewhat bitter and acid, palewhite in colour. The tree on which this variety is produced is rounded and flattened from above, and has generally yellowish appearance. The fruit is used for pickles, preserves, and marmalade. It is, however, rarely cultivated alone.

The following are the three varieties :—

a. **Citrus medica limonun. Vern.** Jamburi. The fruit of this variety has a wrinkled and somewhat loose skin, and the pulp is exceedingly acid. The plant is only used as a stock to bud oranges. There are, however, many sub-varieties of Jamburi, which may not be discussed here.

b. **Citrus medica,** var. **limetta.** True Sweet Lime. **Vern.** Sakhar Limbu. The fruit of this tree has a sweetish taste at all stages, like sugar and water. The tree is yellowish in appearance. It is rarely cultivated in gardens and is of little practical importance.

c. **Citrus medica**, var. **acida.** Sour Lime. **Vern.** Kagdi Limbu. This tree has small leaves and small round fruits, which are largely used for pickles and drinks. There is considerable cultivation of this tree all over the Bombay Presidency. Two sub-varieties are found. One of these is thick-skinned and is termed **Godhadi ;** the other is thin-skinned and is the true **Kagdi Limbu.** The former is specially suited for making pickles. A third variety is sometimes met with in the Sholapur District, called **Pat Limbu,** with a long and thin-skinned fruit.

Citrus aurantium, the Orange, occurs in two main types which are distinguished by the adherence of the skin to the pulp. In the Santra group, the skin is quite loose, and has a beautiful golden yellow colour ; in the Mosambi group the skin is tightly attached to the pulp. The following are the principal varieties in the Bombay Presidency :—

1. Loose Skinned Varieties :—

a. **Santra.** This is the most popular of all the citrus fruits, and is easily recognised by the loose skin and beautiful golden colour and globose shape. The flavour is agreeably sweet, yet acid. The shape of the tree is that of an inverted cone. Its leaves are small and bright green. This sub-variety is largely cultivated in the Poona, Ahmednagar and Khandesh Districts.

b. **Ladoo.** The fruit of this tree is inferior in flavour to Santra. It is flattened on the top (the stigma end) and somewhat drawn out at the stalk end. The colour of the skin is deep orange. A miniature fruit, with about six carpels, is often found within the fruit at the stigma end. The juice is sweet, and the fruit is often almost seedless. The shape of the crown of the tree is rounded, the branches short, numerous and compact, and the leaves small. This type is only occasionally seen in Santra gardens.

c. **Kawla.** This is a very inferior orange. The colour of the skin is more attractive than that of Ladoo, but the pulp is much inferior in quality. The fruit is characterised by a circular rind near the apex. Its juice is scanty and the seeds are many. The tree is tall and the leaves look crumpled and pale yellow, as if the tree badly needed water.

This tree is rarely seen in orange gardens.

d. **Reshmi Naring.** The fruit of this variety is small and worthless containing many seeds, while the juice is very scanty. The tree is large and very prolific.

It is rarely seen in gardens.

2. Tight skinned varieties :—

The **Mosambi** is the only variety commonly grown in gardens on a large scale. The fruit has faint vertical ridges, and a flat ring on the top. The skin is closely attached to the pulp, and not easily separable from it. Its flavour is less piquant than that of the Santra and the colour of the pulp is much lighter. The tree is large, with spreading branches and dark green foliage. There are two sub-varieties of the Mosambi. The fruit of one is thin-skinned (**Kagdi**) and that of the other is thick-skinned (**Godhadi**). The former is the better, but both types are commonly cultivated in gardens.

The Naval Orange, the Malta Blood Orange, and the Jamaica Orange are sometimes grown in gardens, but these types have not yet found their way into the practice of the ordinary cultivators.

Pests and Diseases.—

1. Aphides. From November to February young branches of all citrus species are often infested with colonies of black insects which suck juice from branches and leaves and excrete a sweet liquid on the leaves. The consequential stickiness of the leaves attracts ants. A good remedy is to spray the leaves and twigs with tobacco decoction or with an emulsion of fish-oil-resin soap in water.

2. The lemon caterpillar is another pest which devours leaves. Fresh broods of these insects appear in April, June and November. They are brown with white markings and resemble dropping of birds. Later on, they change to vivid green. No better remedy than hand-picking and destroying them is known.

3. Die-back of Citrus. This disease affects the branches principally the terminal ones. The twigs dry up from the tip downwards and the leaves turn yellow. Clusters of several buds appear in a leaf axil, and the development of branches from the multiple buds frequently results in a bushy rosette-like growth. The internodes may also be shortened and with unusual branching cause a thick bushy head. In the Bombay Presidency citrus trees are usually affected in heavy, ill-drained soils, and in soils with an impervious subsoil. In the former case the removal of the excess of water is, of course, the means of prevention and this is

done by digging deep trenches in the affected orchard and filling them up with stones, leaves, etc.

4. Gummosis of citrus. The disease is widely prevalent in the citrus growing districts of the Bombay Presidency. Sweet varieties of citrus are more susceptible than the sour varieties.

This disease almost invariably occurs at the collar or crown of the tree, starting at the bud-union and always travelling further up and very rarely below the joint. The most reliable symptoms are the peeling or breaking of the bark in a longitudinal manner at the spot accompanied by the exudation of amber coloured gum ; this is followed up, either immediately or later on, by the unhealthy appearance of the entire plant. The disease can be controlled by the proper removal of the affected bark and treating the exposed wood by 50 per cent. solution of crude carbolic acid. The wound should then be covered over by a thin paint of tar to protect it from extraneous wood-attacking organisms (Consult leaflet No. 8 of 1926 of the Bombay Department of Agriculture, for details).

Area. The total area under oranges and other citrus fruits in the year 1925-26 was 5,146 acres, Poona district claiming about 33 per cent. and Ahmednagar 27 per cent. of the acreage. East Khandesh, Nasik and Ahmedabad grow between 100 to 200 acres each. Oranges are not grown in the Konkan and only to a very small extent in Gujarat. On the other hand, there is a fair area under pomeloes in the Thana district. But on the whole, the Bombay Presidency is an importing centre of citrus fruits, receiving oranges in particular from Nagpur, East Africa, Italy and Persia. There is however a small export trade to the Punjab, Kathiawar and Karachi.

2. FERONIA, Corr.

A spiny tree : *leaves* alternate, unequally pinnate ; *leaflets* 3 to 9, opposite, sessile : *flowers* small, polygamous, in lax panicles ; *calyx* 5-toothed ; *petals* 5-6, free ; *stamens* 10 to 12 in one series ; *ovary* with 5-6 parietal placentas : *fruit* a globose, 1-celled, many-seeded berry with a woody rind and filled with pulp.

1. **Feronia elephantum,** Correa. WOOD APPLE. ELEPHANT APPLE. **Vern.** Kavath (M) ; Belawala Kai (K) ; Kavit (G) ; Katori Kavath (S). A moderate sized tree, flowering in March : *leaves* smelling of aniseed when bruised : *fruit* 2 inches and upwards in diameter, globose ; *pericarp* rough, grey coloured ; *seeds* embeded in the edible pulp.

Common throughout the Presidency and often cultivated. Firminger (6) remarks as follows on this plant :—" A common jungle tree of this country. The fruit is round, of pale green colour and about the size of a cricket ball. When the hard shell-like rind is cracked, the interior is found full of brown, soft, mealy kind of a substance, rather acid, having a strong smell of rancid butter and by no means palatable. It ripens in October. Dr. Wight says ' The pulp of the fruit affords a very pleasant jelly, so closely resembling black currant jelly as to be only distinguished by a trifling degree of astringency. The jelly, however,

I have prepared from it appeared to me to possess rather the flavour of apple, with a sharp cider taste and to be such as it is not likely would be approved of by many,".

10. RHAMNACEÆ

Trees or shrubs : *branches* sometimes spinescent : *leaves* alternate, leathery : *flowers* small, greenish, hermaphrodite or bisexual, solitary or fascicled ; *calyx* 4-5-fid; *petals* 4 to 5, hooded ; *stamens* 4-5, opposite to the petals ; *disk* broad ; *ovary* usually 3-celled ; *ovules* usually 1 in each cell ; *style* short, usually 2-4 fid : *fruit* drupaceous ; *seeds* with fleshy albumen.

1. ZIZYPHUS. Adans.

An evergreen tree : *branches* armed with spines, woolly : *leaves* more or less two-ranked : *flowers* in short axillary cymes ; *ovary* sunk in the disk ; *styles* 2, connate for about half their length : *fruit* a drupe with a 2-celled stone.

1. **Zizyphus Jujuba,** Mill. **Vern.** Bor (H) ; Bori (M) ; Ber (G) ; Barihannu (K) ; Berjangri (S). A small tree with a crooked trunk : *bark* dark, deeply cracked : *branches* spreading : *thorns* in pairs, one curved and the other straight : *leaves* serrate, ovate or suborbicular, dark green above, clothed below with white or yellow tomentum : *fruit* globose, or ellipsoid, from ½ inch to 2 inches long, yellowish when ripe.

There are several varieties of Bors all referable to one or the other of two classes : (*i*) Round, such as Benarasi, Kirani of East Khandesh, and (*ii*) Long and oval such as Safarchandi, Palaskhedi of East Khandesh.

Flowering at the end of the rains and fruiting in the cold weather. Believed not to be a native of the Presidency, but naturalised everywhere. Wild trees bear inferior fruits. That its fruit is considered very delicious by the people of India, and it is said that Mahomet included it among the joys of Paradise ; that it has a peculiar perfume which requires early training to enjoy is well known, but the fact does not detract from its practical value. Like other fruit-trees raised from seed there is a great variety in the size, shape, and flavour of the fruit. The best are elliptical, two inches in length by one in thickness, and are propagated by inarching or budding on seedlings of the common sort. This fruit may be grown to perfection in districts with scanty rainfall, and is benefitted by pruning away the small branches after the fruit is gathered in January or February.

11. VITACEÆ

Perennial shrub, scandent by means of tendrils : *leaves* palmate, alternate, stipulate : *flowers* pentamerous, in large compound panicles ultimate divisions umbellately cymose ; *petals* cohering, calyptrate ; *stamens* inserted below the margin of the disk ; *ovary* usually 2-celled ; *style* short or absent ; *ovules* two in each cell : *berry* ovoid or sub-globose, 1-2-celled ; *cells* 1-2-seeded.

1. VITIS, L.

As above.

1. **Vitis vinifera,** L. GRAPE VINE. **Vern.** Angur (H); Draksha (M); Darkshi (G); Draksha (K). *Leaves* suborbicular, cordate, 5-lobed; *margins* with unequal teeth; *surfaces* smooth above, with grey, deciduous tomentum below.

The following is the classification of the local varieties of grapes :—

Class A.—*Leaves* deeply, acutely toothed: *tendrils* interrupted: *berries* white, round.

Leaves leathery: *bunches* inverted, pyramidal; *berries* crowded and with white bloom .. 1. **Bhokri** or **Abi.**

Leaves covered with whitish hairs: *bunches* small; *berries* thickly set .. .. 2. **Gosai.**

Leaves membranous: *berries* pink .. .. 3. **Gulabi.**

Class B.—*Leaves* large, leathery, shallow-toothed: *tendrils* interrupted: *bunches* thick, oblong; *berries* long, crowded, narrow at base and broad at apex, amber, long 4. **Sahebi.**

Leaves softly leathery; basal *lobes* meeting: *bunches* large, elongated, broad at base; *berries* broad at base and pointed at apex .. .. .. 5. **Fakadi.**

Class C.—*Tendrils* interrupted or continuous: *leaves* smaller than those of **Bhokri**; *teeth* much more pointed and deeper: *bunches* small, rather rounded; *berries* small, round, black thinly set, reddish purple before ripening and perfectly black when fully ripe with cardamum flavour .. .. 6. **Karawandi or Black Prince.**

Tendrils continuous up to 7 nodes: *leaves* very broad, covered on the back with a thick setting of appressed rusty white hairs: *berries* small, roundish, very thinly set .. 7. **Neelum.**

Class D.—*Tendrils* interrupted: *berries* big, long, black.

Leaves like those of *Fakadi*: *bunches* medium-sized, rather broad and fully set and round; *berries* elliptical	8.	**Kandhari..**
Leaves deeply 5-parted, not much toothed: *bunches* oblong, heavily shouldered; *berries* oblong with a pit on the tip, bluish before ripening and black later ..	9.	**Kali or Hafshi.**

Diseases and Pests.

Powdery Mildew. This is a very destructive disease of the grape vine in India. It attacks all the aboveground parts of the vine,—leaves, shoots, blossoms and fruits. The young berries are the most severely affected. The disease can be most effectively controlled by sulphur dusting (refer to leaflet No. 6 of 1928 of the Bombay Department of Agriculture).

Anthracnose. This disease of the grape is not as serious as powdery mildew; but during wet and cool years it becomes more destructive than the latter. The disease is characterised by the cankers or scars which it produces on the leaves and shoots. The well-known bird's-eye spots produced on the berries are also very characteristic. The disease can be controlled by the application of Bordeaux mixture (refer to leaflet No. 1 of 1928 of the Bombay Department of Agriculture).

Udadya Beetle. Immediately after the pruning for the sweet crop, these small beetles of a dull coppery colour with dark spots on wings, eat into the growing buds which are sprouting in October and November. The loss of these sprouts means the loss of the whole crop. The well known remedy is to trap them in tassels made of dry strips of plantain leaves placed at night among the spurs and crutches of the vines, and then kill them in the morning.

Pollination. The flower of the grape vine is so constituted that self-fertilization is generally and readily accomplished. The pistil and the stamens are covered by a " cap " formed by the united petals which are greenish just before expansion. Fertilization is effected in bright sunlight by the rolling up of the various segments (petals) of the " cap " one after another until at last it rests on the point of the stamens and pistil. By a sudden jerk it is thrown off, the stamens suddenly relieved from the pressure of the cap fly apart, and at the same time the pollen is projected on to the stigma and pollination is effected.

Area. In 1925-26 the total area under grapes was 990 acres including 87 acres in Sind. Of this, 76·5 percent is contributed by Nasik District alone. Of the remaining area, about one-half is found at and near Ahmedabad and nearly half in the Junnar taluka of the Poona district. Grapes from Nasik are sent to Bombay, Poona, Calcutta, Lahore, Agra and other cities, while some fruit comes into the Bombay Presidency from Quetta, Malta, and even from Spain. The cultivation of grapes is extending very fast at and near Nasik, which is found particularly suitable for this crop, and also in Khandesh especially near Jalgaon (Nasirabad).

12. ANACARDIACEÆ

Trees with acrid juice : *leaves* alternate, simple or compound, exstipulate : *flowers* small, paniculate, unisexual or polygamous ; *calyx* 3-5-partite ; *petals* 3-5 ; *disk* flat annular, entire or lobed ; *stamens* usually equal in number to the petals ; *ovary* superior, 1 or 2 or 6-celled ; *style* 1-4 ; *ovules* 1 in each cell, pendulous or ascending : *fruit* usually a 1-5-celled, 1-5-seeded drupe ; *seed* exalbuminous.

A. *Ovules* ascending.

Leaves simple : *flowers* polygamous ; *Stamens* 1-5 : *fruit* a fleshy drupe .. 1. **Mangifera.**

Stamens 8-10 : *fruit* a reniform nut .. 2. **Anacardium.**

B. *Ovules* pendulous

Leaves pinnate : *ovary* 4-5-celled .. 3. **Spondias.**

1, MANGIFERA, L.

A tree : *leaves* simple, entire, coriaceous : *flowers* small, polygamous, numerous in terminal panicles ; *calyx* 4-5-partite ; petals 4-5, free, imbricate ; *disk* fleshy, 5-lobed ; *stamens* 1-5, one usually perfect and larger than the others, inserted within the disk or on it ; *ovary* 1-celled oblique ; *ovule* solitary, ascending : *drupe* large, fleshy, with a tough epicarp ; *stone* compressed, fibrous; *seed* large, compressed, *testa* papery, *cotyledons* plano-convex.

1. **Mangifera indica,** L. MANGO. **Vern.** Am (H) ; Amba (M) ; Amb (S) ; Mavinhannu, Mava (K). A large evergreen tree, with widely spreading branches and dark bark, all parts except the inflorescence quite glabrous : *leaves* crowded at the ends of the branchlets, shininge, oblong or oblong-lanceolate, 5-10 inches long : *panicles* terminal ; *flowers* with a disagreeable scent ; *petals* yellow, with 3-5 darker ridges on the inner face : *drupes* obliquely pear-shaped or subovoid, from 3-8 inches long.

The mango tree flowering from January to March and ripening its fruit from April to July, is cultivated everywhere in the Presidency and throughout the Tropics generally. It is said to be wild in the Western Peninsula from Khandesh southwards.

The Bombay Presidency has long been celebrated for the excellence of its mangoes.

Burns and Prayag (2) have made a special study of the numerous varieties of the mango found in the Bombay Presidency. The following information is taken from their book, "Book of the Mango," Bulletin No. 103 of 1920 of the Department of Agriculture, Bombay.

Classification. In India, there is a very large number of the varieties of mango. No attempt has been made to prepare a thorough classification of them by examining all varieties available. A considerable number of Bombay varieties have been examined by Burns and Prayag (The Book of the Mango—Bulletin No. 103 of 1920, Department of Agriculture,

Bombay), and an artificial classification based on the form of the fruit, has been adopted. The three main classes suggested are :—

Class I.—Round fruited : those varieties in which the length from stalk to apex is equal to or less than the breadth.

Sub-class I. Roos. Rounded :—

Names—*Roos, Dilpasant, Bishop, Rawanya, Karemav, Gadhemar, Dilhouse, Dildar, Gendya.*

Sub-class II —*Ramphalya*—very broad in proportion to length : —

Names—*Cheep, Ramphalya, Mogarya, Sakhargotya, Fulambry Sakharkand, Gulkand, Dilkush.*

Sub-class III—Dalimbya, shoulders ridged :—

Names—*Dalimbya* of Khedshivapur and Nandgaon.

Class II—long fruited : —Those varieties in which the length is distinctly greater than breadth.

Sub-class I. *Banti.* Much elongated :—

Names—*Banti, Dodi, Calcutti, Kharki, Shravandodi, Kelya, Kalmi, Collace, Chhatrapati, Ghadiyali* (*Menavli*) *Bhungya.*

Sub-class II. Totapuri Elongated with downward pointing beak.

Names—*Popatya, Popatia, Modya, Totapari, Saundadya.*

Sub-class III. *Cowasji Patel.* Elongated slight beak and shoulders.

Names—*Cowasji Patel, Karel, Godhadya.*

Sub-class IV. *Alphonso.* No beak, high left shoulder.

Names—*Alphonso, Aphus, Fernadin, Musherad, Ilar, Goa Alphonso, Mankurad, Rebel, Katarya, Madanban, Jamb.*

Sub-class V. *Pairi.* Broad marked beak.

Names—*Pairi, Khobarya* (of *Menaoli*) *Sundri* (*Menaoli*) *Surki* (*Menaoli*) *Masana* (*Navasari*) *Makhanio* (*Nawashoro*) *Birbal* (*Nandgaon*) *Badsha* (*Nandgaon*) *Kalya* (*Nandgaon*) *Dattapuri Maharani* (*Nandgaon*), *Gomantki Shendadya* (*Nandgaon*) *Khobrya* (*Big*) *Gopto* (*Navasari*) *Romanio* (*Navasari*) *Kalakhoont of Menaoli, Khirasindha* (*Khed-Shivapur*).

Detailed description of these varieties are given at pages 83 to 98 in Bulletin No. 103 of 1920 of the Department of Agriculture, Bombay, entitled " The Book of the Mango " by Burns and Prayag. Outline of these varieties are also given therein to show their shapes.

Class III. Indefinite. Those that fall in neither class on account of being on the border line between the other two classes and in addition, of somewhat variable nature.

Names—*Kaju, Walkya, Belya, Walkya, Kurhadya, Balshepya, Kharbuja, Nagya, Angirya, Manohar* (*Khed-Shivapur*).

Flowering and pollination.—The normal period of mango flowering extends from the last week of November to the end of January, the corresponding fruits ripening from May to middle of July. Cases of flowering

at other than normal times are on record. At Trombay, trees are known to flower early in November and some to flower till the end of March. September flowering is recorded from several places in the Presidency. Some plants are known to flower both in September to October and in January.

Self-pollination though not a rule seems to take place in many cases as witnessed by the close contact of the anther and stigma and the deposit of pollem on the stigma. Crossing also seems to take place abundantly as the flower is adapted to pollination by flies attracted by the honey which is actively secreted by the nectary (disc.)

Pests, diseases, etc.

Jassids. At the usual flowering time small sucking bugs crowd round the flowers and small fruits whose tissues they puncture and suck sap from. In consequence, the flowers as well as young fruits drop before maturity. A succession of broods may take place during the whole of the fruiting season and very seriously affect the yield. The most useful remedy is to begin to spray the trees one week before they flower with an emulsion of fish-oil-rosin soap in water and continue the spraying about once a week until the mangoes are of the size of a marble.

Borer. In old trees the bark is found tunnelled by a borer (*Butocera rubra*) which mines the trunk in straight lines or zigzag. Its presence is recognised by saw-dust-like, chewed material at the bottom of the trunk as also by tapping the bark with a piece of wood, when one hears a hollow sound. Only a few of these grubs are enough to kill a large old tree. The remedy is to scoop out the grub by a stout penknife or to thrust a stiff piece of wire into the tunnels till it reaches the grub, pierces and kills it there.

Scale insect (*Aspidiotus destructor*). These insects cover the tender, younger branches and both surfaces of leaves. Individual trees here and there are attacked. The remedy is to spray with rosin wash.

Shoot borer. About the latter half of the monsoon the caterpillar of a small moth, *Clumetia transversa*, is found tunnelling tender shoots one after another as the latter appear. Its attack is very much noticed on grafted trees by the withering of the young shoots. The effect is that all fresh growth is checked during seasons of active growth. No remedy is likely to be beneficial except to cut off withering shoots and burn them together with the enclosed borers.

Sooty mould (*Capnodium*), is a fungus which grows on the honey dew secretions of certain insects and forms a dense black covering on leaves. The injury caused is due to the consequential interference with the action of chlorophyll and not due to parasitic action. The remedy is the destruction of the primary cause, the aphides, which are killed by spraying with fish-oil-rosin soaps.

Mildew or blight. It is a very serious disease of the mango in the Konkan. No definite recommendations have been made regarding the control of this disease ; but recent work done in Poona and Ratnagiri tends to show that the disease can be controlled by sulphur dusting.

Abnormal inflorescence. This is a malformation of the flowering shoots. All flowers become very much crowded together on shortened and thickened ones and present a ball-like appearance in which no flowers open nor is any fruit formed. Sometimes a branch here and there may become diseased or a whole tree may be involved. No insect or fungus has been found to be the cause of it.

2. ANACARDIUM, L.

A small tree : *leaves* simple, leathery : *flowers* polygamous, in terminal panicles ; *bracts* conspicuous ; calyx 5-partite ; *petals* 5, deflexed ; *disk* filling the base of the calyx ; *stamens* 8-10 ; one larger than the others, and exserted beyond the petals ; *filaments* connate, and adnate to the disk ; *ovary* obovoid, or obcordate ; *ovule* solitary, ascending : *nut* reniform ; *pedicel large*, pyriform, fleshy ; *pericarp* cellular, and full of oil ; *seed* reniform.

1. **Anacardium occidentale,** L. Cashew nut. **Vern.** Kaju (H) ; Kaju (M) ; Kaju (G) ; Kaju, Kempukerubija (K). Trunk short, thick, crooked ; *bark* rough, becoming deeply cracked : *leaves* 4-8 inches long, obovate, apex rounded, base cuneate, main nerves prominent beneath : *panicle* longer than the leaves with cymose branches ; *bracts* $\frac{1}{2}$ inch long, gibbous, ovate acute ; *petals* lanceolate, yellow with pink stripes ; *ovary* attenuated into a subulate style : *nut* 1 inch long ; *pedicel* fleshy.

A native of Tropical America, naturalised and cultivated in large numbers on the coast ; rarely seen in the inland districts and then only in gardens, flowering in January and ripening its fruit at the end of the hot weather.

The so-called fruit is the thick fleshy stalk. As a fruit it is not of much value but more might have been effected in its improvement by selection. The nuts are eaten roasted and the flavour is considered good by most people. Between the shell and the kernel is an acrid brown oil.

3. SPONDIAS, L.

Small, deciduous trees with grey bark : *leaves* oddpinnate, alternate, placed at the ends of the branchlets : *panicles* terminal, spreading ; *flowers* small, polygamous, pinkish green ; *calyx* small, 5-toothed ; *petals*, 4-5 ; *disk* cupshaped, broad ; *stamens* 8-10, inserted beneath the disk, about half as long as petals ; *ovary* 4-5-celled ; *ovules* solitary in each cell ; *styles* 4-5 conniving : *drupe* fleshy, ovoid, yellow ; *flesh* very astringent ; *seeds* usually 1, rarely two or three.

Panicles long : *stone* rough	1. **S. mangifera.**
Panicles short : *stone* smooth	2. **S. acuminata.**

1. **Spondias mangifera,** Willd. Hog Plum. **Vern.** Jangli am (H) ; Ambada (M) ; Ranamba (G) ; Amatemara (K). *Leaflets* 4 to 5 pairs, entire, oblong, oblique, main nerves numerous, horizontal, running into a strong intramarginal vein : *stone of drupe* woody, hard, rough, with irregular furrows and cavities.

Flowers appear at the beginning of the hot weather and fruits ripen during the ensuing cold season.

This is often planted for the sake of its fruit, which is not, however, palatable. It is well described by Firminger who says that the fruit when largest is of the size of a goose's egg, of a rich olive green, mottled with yellow and black, with but a trifling degree of scent and none of the quincelike odour of the other species. The inner part near the rind is rather acid, but that being removed, the part nearest the stone is sweet and eatable. But withal it is not an agreeable fruit.

2. **Spondias acuminata,** Roxb. **Vern.** Ambada (M); Kodambada (K).

This differs from the above chiefly in the large number of its crenate serrate leaflets and the smaller drupes which have quite smooth stones. It is a slender tree, flowering and fruiting at the same times as the last and extending throughout the same area. The fruits are often eaten and are also preserved in pickle. This tree is so common in some places, for example, the Bassein Fort, as to justify the assumption that it is or has been often really cultivated.

13. MORINGACEÆ

A fast growing, soft wooded tree : *leaves* alternate, tripinnate, pinnae and pinnules oddpinnate and opposite ; *leaflets* quite entire, obovate : *flowers* in large panicles, white, bisexual, irregular ; *calyx* cupular, with 5 lobes ; *corolla* of 5 unequal petals, the upper smaller, the lateral ascending the anterior the larger ; *disk* lining the calyx tube ; *stamens* declinate, 5 perfect opposite the petals alternating with 5 staminods ; *anthers* 1-celled ; *ovary* stalked ; *ovules* numerous, biseriate ; *placentation* parietal ; *style* slender, tubular ; *stigma* perforated : *capsule* elongate, beaked, 3-6-angled, 1-celled, loculicidally 3-valved ; *seeds* many, in pits of the valves, *testa* corky.

1. MORINGA, Juss.

As above.

1. **Moringa Oleifera,** Lam. (M. Pterigosperma, Gaertn.). Drumstick Tree. Horse Radish Tree. **Vern.** Soanjna Shevga (H); Shevga (M); Sekto, Surgavo (G); Nuggi Marra (K); Swanjera (S).

Flowering and fruiting at various times throughout the year. It is cultivated largely throughout the whole of India and is said to be wild in the forests of the Western Himalayas. The root is used in cookery as a substitute for horse radish. The flowers and leaves are also eaten and the young unripe pods, known as drumsticks are a favourite ingredient in curries. An oil, called Ben oil, is said to be extracted from the seeds and is highly valued by watch-makers and others for lubricating delicate parts of machinery.

14. LEGUMINOSÆ

Herbs, shrubs or trees : *leaves* alternate, usually stipulate, compound (rarely simple) ; *leaflets* sometimes stipellate : *flowers* usually irregular

and hermaphrodite ; *sepals* 5, combined or free, often unequal ; *petals* 5, usually irregular and imbricate ; *stamens* normally 10, perigynous or subhypogynous ; *filaments* free or variously combined ; *anthers* 2-celled ; *ovary* superior, 1-celled, with few or many uniseriate ovules ; *style* often declinate : *fruit* a legume or a lomentum, dehiscent or indehiscent or breaking up into 1-seeded joints ; *seeds* usually exalbuminous, *cotyledons* foliaceous, or amygdaloid.

PAPILIONATÆ.

Corolla papilionaceous, that is with irregular, imbricated petals, the standard or the uppermost outermost, the two lateral called wings and the two lowest cohering into a boat-shaped body called the *keel*, in which the declinate stamens and pistil are usually enclosed ; *stamens* 10, diadelphous or monadelphous.

Tribe I. **Genisteae.**—*Leaves* simple : *stamens* monadelphous : *pods* dehiscent, not jointed, turgid ; *seeds* becoming loose before dehiscence commences .. .. .. 1. **Crotalaria.**

Tribe II. **Trifolieae.**—*Leaves* trifoliate : *stamens* diadelphous : *pod* usually dehiscent, not jointed.

Leaves pinnately trifoliate : *pod* elongate, beaked .. .. .. 2. **Trigonella.**

Pod spiral .. .. .. 3. **Medicago.**

Leaves palmately trifoliolate.

Petals persistent, adnate to the staminal tube : *pod* small, mostly indehiscent, quite covered by the calyx .. .. 4. **Trifolium.**

Tribe III. **Galegeae.**—*Leaves* trifoliolate or unequally pinnate : *stamens* usually diadelphous : *pods* dehiscent, not jointed, hairs fixed by the centre.

Stamens monadelphous .. .. 5. **Cyamopsis.**

Stamens diadelphous .. .. 6. **Indigofera.**

Tribe IV. **Vicieae.**—*Leaves* equally pinnate ; *petiole* ending in a tendril or bristle : *stamens* diadelphous : *pod* dehiscent, not jointed.

Leaflets toothed : *style* not bearded 7. **Cicer.**

Leaflets entire : *style* bearded :

Staminal tube oblique at mouth .. 8. **Lens.**

Staminal tube truncate at mouth :

Style flat, dilated at tip .. .. 9. **Lathyrus.**

Style dilated upwards throughout .. 10. **Pisum.**

Tribe V. **Hedysareae.**—*Leaves* odd pinnate : *stamens* diadelphous or monoadelphous : *pod* jointed if more than one-seeded.

Stamens monoadelphous : *fruiting peduncle* elongate, recurved, forcing the fertilised ovary into the ground under the surface of which the fruit ripens .. .. .. 11. **Arachis.**

Tribe VI. **Phaseoleae.**—Usually climbing herbs : *leaves* pinnately trifolialate : *stamens* monoadelphous or diadelphous : *pod* dehiscent, not jointed.

Leaves not gland-dotted ; *leaflets* stipellate.

Style not bearded ; *stamens* monoadelphous ; *petals* about equal in length.

Nodes of raceme not tumid.

Stipels and bracts small, caducous ; *anthers* uniform, all fertile .. 17. **Glycine.**

Nodes of raceme tumid.

Upper lip of *calyx* projecting .. 12. **Canavalia.**

Style bearded below the stigma ; *stamens* diadelphous.

Stigma oblique.

Keel spiral .. .. .. 13. **Phaseolus.**

Keel not spiral .. .. 14. **Vigna.**

Stigma terminal.

Pod flat .. .. .. 15. **Dolichos.**

Pod square, 4-winged .. .. 16. **Psophocarpus.**

Leaves gland-dotted below ; *stipels* often abortive : *nodes* of *raceme* not tumid ; *style* not bearded below the stigma.

Pod with depressed lines between the seeds .. .. .. 18. **Cajanus.**

1. CROTALARIA, L.

Tall herb : *leaves* simple ; *stipels* very minute : *flowers* in long terminal and lateral racemes, yellow ; *calyx* gamosepalous, teeth deep, linear-lanceolate ; *corolla* exceeding the calyx, *standard* ovate oblong subacute, *wings* obovate, *keel* broad, distinctly beaked : *pod* sessile, inflated ; *seeds* many, becoming detached from the suture of the pod before its dehiscence.

1. **Crotalaria juncea,** L. SUNN HEMP. **Vern.** San (H) ; Tag (M) ; Sánabu (K) ; Sana (G) ; Sini, Tagsana (S).

Pollination. Self-pollination is the rule in this plant. There are two sets of anthers : the subulate and the round ones. The latter come in contact with the stigma before or about the time of their maturity and thus effect self-pollination. Cross-pollination is rare.

This plant is said to be doubtfully wild in India and plants found in waste places are really escapes from cultivation. As a crop it is found in all districts of the Presidency. The more important centres of cultivation are Ahmedabad, Panch Mahals, Surat, Khandesh, Nasik, Satara, Belgaum, Thana and Ratnagiri. It is usually grown in the kharif season but in the coast districts it is grown as a rabi crop following rice. Besides being grown on account of its fibre, the plant is largely used as a green manure crop.

2. TRIGONELLA, L.

Annual robust erect, subglabrous herb : *leaves* pinnately trifoliolate ; *leaflets* toothed : *flowers* racemose, yellow ; *calyx tube* campanulate, *teeth* distinct ; *petals* free from the staminal tube ; *standard* and *wings* narrow, *keel* shorter, obtuse ; *stamens* diadelphous ; *filaments* not dilated ; *anthers* uniform ; *ovary* sessile, many-ovuled ; *style* glabrous ; *stigma* terminal : *pod* linear or oblong, compressed or subterete, not spiral, usually exserted, many-seeded, continuous within.

1. **Trigonella Foenum-Graecum,** L. Fenugreek. **Vern.** Methi (H) ; Methi (M) ; Methi (G) ; Menthia (K). *Leaflets* toothed up to 1 inch long, oblanceolate oblong ; *stipules* not laciniated : *flowers* 1 to 2, sessile in the axils of the leaves ; *calyx* teeth linear ; *corolla* much exserted : *pod* 2 to 3 inches long, 10 to 20-seeded, with a long persistent beak.

Cultivated as a cold season crop for vegetables and also for its seeds which are used in spice.

3. MEDICAGO, L.

Erect, pubescent herb : *leaves* pinnately trifoliolate, petiolate ; *stipules* lanceolate, toothed acuminate, ribbed and toothed ; *leaflets* oblanceolate, toothed on the margin ; *tip* truncate ; *mid-rib* produced : *flowers* in axillary, subcapitate racemes ; *bracteoles* filiform ; *calyx* tube campanulate, with sub-equal, long teeth ; *corolla* exserted, purple, *standard* and *wings* oblong, *keel* straight, obtuse ; *stamens* diadelphous ; *anthers* uniform ; *ovary* sessile : *pod* twisted into a double spiral, indehiscent.

1. **Medicago sativa,** L., Lucerne or Alfalfa. **Vern.** Vilayati Gavat (M) ; Lasunghas (H) ; Vilayati hullu (K).

Pollination. Cross-pollination is the rule. The stamens and pistil are held under a tension due to the grip of the keel and wings. By the weight of an alighting insect upon the wings, the stamens and pistil spring out of the keel and strike the body of the insect.

Diseases and pests.

Green fly. Fields of lucerne are often attacked from March to May by tiny green or yellow insects commonly called green fly or aphis, Vern.

Mowa. A sugary substance is exuded by the aphis on the leaves on the underneath of which they are concealed. These insects injure the young leaves by sucking sap and ultimately kill the whole plant. The attack of aphis is detected by the presence of ants which come to feed on the sugary substance. The remedy consists in spraying the plant immediately after cutting with kerosene emulsion or Incosopol. The spray should be specially directed against the bases of plants as the aphis culsters round there.

Dodder. It is a phanerogamic parasite consisting of yellowish wire-like stems encircling the lucerne plants and killing them. The remedy is to get lucerne seed free from that of Dodder with which it is sometimes mixed.

Extensively grown through the Presidency under irrigation as a forage crop, especially for horses. It is said to be a native of Western Temperate Asia.

4. TRIFOLIUM, L.

Annual : *leaflets* palmate, mostly sessile entire or denticulate ; *stipules* adnate to the petiole : *flowers* small, white, yellowish white in dense heads or spikes ; *calyx* persistent nearly equally toothed ; *teeth* long subulate ciliate ; *petals* withering more or less adnate to the stamen tube ; *style* filiform, beardless ; *stigma* more or less oblique.

1. **Trifolium alexandrinum,** L. BERSEEM. EGYPTIAN CLOVER. **Vern.** Shaftal (S). Erect deep rooting herbs, lightly pubescent or glabrate 1-2 feet with branched and hollow ridged stems ; *leaflets* ovate oblong, $1\frac{1}{2}$ to $1\frac{3}{4}$ inch long with entire margins : *flowers* in dense globular to oblong ovate short peduncled heads arranged cymosely with bract-like involure at base ; each capitulum consists of 50 small white sessile flowers.

Grown in many parts in Sind as a fodder crop with good results.

5. CYAMOPSIS, DC.

An erect annual, with appressed short, grey hairs, which are attached by their centres : *leaves* trifoliolate : *flowers* small, in axillary racemes ; *calyx tube* oblique, with unequal teeth, *standard* and *wings* of *corolla* narrow, *keel* obtuse ; *stamens* monadelphous ; *anthers* apiculate ; *ovary* sessile, 6-8-ovuled ; *style* short, filiform, incurved ; *stigma* capitate : *pods* linear oblong, with a broad ventral suture ; *seeds* separated by septa.

A genus in India consisting of a single cultivated plant which does not seem to be known in a wild state. It is extensively grown only in Gujarat, being a garden crop of minor importance in other parts of the Presidency.

1. **Cyamopsis psoralioides,** DC. CLUSTER-BEAN. **Vern.** Guvar (M) ; Chavalikai or Guvar kai (K) ; Guar (G).

The following four varieties have so far been distinguished in Bombay and the first is probably the most typical form :—

Variety A of the Deccan. Robust, 2 feet high, all parts white strigose : *stems* angular and ridged, with hairs densest on the ridges : lateral *branches* few : *leaves* stipulate and exstipellate, pinnately trifoliolate ; *stipules* linear, setaceous, $\frac{1}{4}$ inch long ; *petioles* up to $2\frac{1}{2}$ inches long, triangular and concave ; *lateral leaflets* very shortly petiolulate ; *blades* equal, subcoriaceous subpalmately 3-nerved at base, elliptic acute, irregularly dentate, $2\frac{1}{2}$ inches long by 2 inches broad : *racemes* at first $1\frac{1}{2}$ inches long, ultimately attaining to 3 inches in length, rising from all the axils of the leaves, many and densely flowered ; *flowers* pink, fading darker, 5/16 inch long ; *bracteoles* filiform, $\frac{1}{2}$ inch long, larger than the flowers ; *calyx* 5-partite much shorter than the *corolla*, *lobes* unequal in length, linear, setaceous ; *petals* caducous, *standard* obovate, narrow and folded upwards on each side above the base, *wings* falcately oblong, shortly clawed, *keel* ovate, concave, pointed, divided about half way up ; *stamens* 10, monadelphous ; *anthers* brown, apiculate ; *ovary* smooth ; *style* short, bent to a right angle ; *stigma* capitate, green ; *peduncles* and *pedicels* thickened in fruit : *fruit* linear, oblong, curved, pointed, $2\frac{1}{2}$ by 5/16 inches, surface white strigose, ventral suture broad, 3-ridged, *dorsal* narrow ; *seeds* 7, separated by pithy false dissepiments, greenish, rounded, 1/5 by 1/28 inch, *hilum* small, white.

It is said to attain the height of $4\frac{1}{2}$ to 5 feet in Gujarat.

Variety B. Pardeshi of Gujarat. Plants attaining 5 feet and upwards in height, not as much branching as **Makania,** all parts white strigose : *leaves* large ; *leaflets* sometimes 6 by 4 inches : *racemes* short as in the last : *pods* 5 inches long by $\frac{3}{8}$ inch broad, not curved, ventral surface deeply grooved ; *seeds* 11, greenish.

This seems to occur only in Gujarat.

Mollison (12) says that two sorts are known, Khagali, with hairy leaves and Telin, with glabrous, oily looking leaves.

Variety C. Bushy Guvar of Dharwar. *Stems* and all parts extremely robust, scarcely branched : *racemes* $2\frac{1}{2}$ inches long ; lower *flowers* scattered, upper aggregated : *pods* $2\frac{1}{2}$ inches long by $\frac{1}{4}$ inch broad, black strigose ; *seeds* 10, yellowish green.

This variety appears to be confined to the Karnatak.

Variety D. Clustered Guvar of Nadiad. As in **Variety C.** but taller : *racemes* 3 inches, ultimately attaining a length of 5 inches and upwards in fruit : *seeds* greenish, rounded, *hilum* small, white.

Variety E. Sothia of Gujarat. Tall 8 to 10 feet, not branching : *pod* very long, thick and hairy.

Variety F. Makania. Tall, vigorous branching : *pod* long, soft. not hairy.

Variety G. *Seeds* rosy coloured.

6. INDIGOFERA, L.

A small shrub, faintly white hairy, *hairs* appressed, attached by their centres : *leaves* unequally pinnate ; *leaflets* opposite, turning black when dry : *flowers* in short racemes ; *calyx* small campanulate, teeth as long as the tube ; *corolla* caducous, *standard* obovate, *keel* straight, not rostrate, spurred on each side near the base ; *stamens* diadelphous ; *anthers* apiculate ; *ovary* sessile, many-ovuled ; *style* short incurved ; *stigma* capitate : *pod* linear cylindrical.

1. **Indigofera tinctoria,** L. The Indigo Plant. **Vern.** Nili (M) ; Gali (G) ; Nil (H) ; Nili (K) ; Fil, Nil, Nir (S). Leaves 1 to 3 inches long ; *leaflets* up to 1 inch long and $\frac{1}{2}$ inch broad, oblong, oblanceolate : *racemes* 2 to 4 inches long ; *calyx* teeth triangular acute ; *corolla* pink, $\frac{1}{6}$ inch long, *standard* pubescent on the back : *pods* up to $1\frac{1}{4}$ inch long, apiculate, thickened on the sutures.

Pollination.—Very little self-fertilisation takes place in the case of protected flowers, the visits of bees being necessary for seed formation, indicating that cross-pollination takes place as a rule in nature. There is also evidence for believing that self-sterility occurs to a certain extent.

Area.—The area under Indigo crop in this Presidency according to latest records is 1,025 acres. The Nawabshah district of Sind contributes 849 acres and Sukkur 106 and 64 acres in Ahmedabad and the rest in Khandesh.

7. CICER, L.

A viscous, branched annual herb : *leaves* pinnate, rigid ; *leaflets* and *stipels* strongly veined and deeply toothed : *flowers* solitary, axillary ; *calyx* tube oblique, teeth linear, subequal, *standard* broad, narrowed to a wide claw, *wings* obliquely obovate, *keel* incurved ; *stamens* 10, diadelphous ; *anthers* uniform ; *ovary* sessile, 2-many-ovuled ; *style* filiform, incurved, beardless ; *stigma* terminal, capitate : *pod* sessile, oblong, turgid, narrowed into the persistent style ; *seeds* subglobose or irregularly obovoid.

1. **Cicer Arietinum,** L. Gram or Chick-pea. **Vern.** Chola (H) ; Harbara or Chana (M) ; Kadle, Chana (K) ; Chahna, Chano (S). *Leaves* 1-2 inches long, with usually a terminal leaflet ; *stipules* small, obliquely ovate, toothed ; *leaflets* ovate oblong or obovate, deeply cut ; *peduncles* up to $\frac{3}{4}$ inch long, deflexed after flowering ; *calyx* about $\frac{1}{3}$ inch long ; *corolla* about half as long again as the calyx, pink, blue or white : *pod* $\frac{3}{4}$ to 1 inch long, pubescent.

Pollination.—In the bud stage, the anthers occur grouped round the style at a short distance below the stigma. Dehiscence takes place in the bud a day before the flower opens and when the pollen is first liberated, the stigma is still above and quite free from the burst anthers. The filaments now gradually increase in length sufficient to carry the burst anthers above the stigma. This stage is completed before the

flower opens and thus the act of pollination takes place in the bud. Plants under nets also set normally, proving also that self-pollination is the rule.

There are at least four varieties in the Bombay Presidency differing only in the colour of the seeds which are black, reddish brown, yellow and creamy.

Area.—The total area of gram in the Presidency was, in 1922-23, 586,043 acres. Panch Mahals grow the largest area in Gujarat. The crop is important in Kaira and Ahmedabad. In the Deccan, Ahmednagar is the most important district. The crop is extensively grown in all the district of the Karnatak.

8. LENS, Moench.

The smallest of the Bombay pulses, erect, softly hairy, much branched from the base : *leaves* usually equally pinnate, the rachis sometimes ending in a bristle, tendril or a terminal leaflet ; *stipules* semi-sagittate ; *stipels* absent : *flowers* solitary or in racemes, on axillary peduncles ; *bracts* and *bracteoles* usually absent ; *calyx tube* oblique, *lobes* 5, elongate, subequal ; *corolla* pale purple, projecting slightly beyond the calyx teeth, *standard* broad, *wings* oblong, oblique ; *stamens* 10, diadelphous, mouth of tube oblique ; *anthers* unifrom ; *ovary* subsessile, 2-ovuled ; *style* inflexed, bearded minutely on its inner face : *pod* compressed, continuous within, one or two-seeded.

1. **Lens esculenta,** Moench. Lentil. **Vern.** Masur (H, M, G) ; Channangi (K). *Leaflets* small, in 4 to 6 pairs sessile, lanceolate : *racemes* 2-4-flowered ; *peduncles* about as long as the leaves ; *calyx* teeth linear, twice as long the tube, silky : *pod* rhomboid, oblong, about ½ inch long, smooth ; *seeds* usually 2 compressed, purplish brown and slightly marbled in the common variety, a less common variety has a larger, very flat seed of the same colour.

The lentil is a rabi crop and said by Mr. Mollison to be important only in Nasik, Belgaum and Poona.

9. LATHYRUS, L.

A procumbent, glabrous much branched annual : *stems* winged : *leaves* paripinnate in a single pair, the axis ending in a trifid tendril ; *stipules* broad, entire, semisagittate : *peduncles* axillary one-flowered ; *bracts* minute, caducous ; *bracteoles* absent ; *calyx tube* campanulate oblique, teeth lanceolate, about twice as long as the tube ; *corolla* exserted, *standard* broad, *keel* shorter than the *wings* ; *stamens* diadelphous, mouth of tube not oblique ; *anthers* uniform ; *ovary* sessile or stalked, many-ovuled ; *style* flattened, bearded longitudinally on the inner side ; *stigma* capitate : *pod* with a wing on each side of the dorsal suture ; *seeds* 4 to 5, compressed.

1. **Lathyrus sativus,** L. Chickling Vetch. **Vern.** Kesari (H) ; Lang (G) ; Lakh (M) ; Mattar (S). *Leaflets* linear or lanceolate, acuminate ; *petiole* about 1 inch long, winged : *peduncles* as long as or longer than

the petioles ; *corolla* $\frac{3}{4}$ inch long, reddish purple, blue or rarely white, *standard* broad, emarginate : *pod* oblong, $1\frac{1}{2}$ inch long ; *seed* brown or yellowish, marbled with red.

According to Mollison (12) Broach is the chief centre of cultivation. Surat and Nasik also grow it largely and in other districts the area is trifling. In the Deccan, it is a rabi crop following rice ; in Gujarat, it is either the sole crop of the year or it is also grown as a second crop in rice beds.

It used to be believed that the seeds contain poisonous alkaloid and the continued use of them as food causes paralysis in human beings and animals. Dr. Watt (16) says that the poison is volatile and is not present in properly cooked grain.

However, in an article on Lathyrism in "Nature," Vol. 116, No. 2911, p. 260, 1925, Anderson, Howard and Simonsen (1) are referred and it is shown that the poisonous effect ascribed to the consumption of seeds of **Lathyrus** is not due to the stuff from **Lathyrus sativus, L.**, but is due to the consumption of the seed of the weed, **Vicia sativa, L.**

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10. PISUM, L.

Smooth, diffuse or climbing herb : *leaves* equally pinnate, axis ending in a branched tendril ; *stipules* leafy ; *stipels* absent : *flowers* axillary, solitary or in few flowered racemes ; *bracts* small ; *bracteoles* absent ; *calyx tube* oblique, 5-lobed ; *corolla* exserted, *standard* broad, *wings* oblong falcate, *keel* short, incurved obtuse ; *stamens* diadelphous ; *anthers* uniform ; *ovary* subsessile, many-ovuled ; *style* inflexed, compressed above and longitudinally bearded on the inner side : *pod* continuous within, rather furgid ; *seeds* subglobose. Self-pollination is the rule.

1. **Pisum sativum,** L. Garden Pea. **Vern.** Mattar (H) ; Vatana (M) ; Batagadle (K) ; Vatana (G) ; Larkana (S). *Stipules* ovate, half cordate, toothed at the base ; *leaflets* in 3 pairs, ovate entire, wavy at the edge : *peduncle* 2-many-flowered ; *flowers* white : *seeds* globose, uniform green or yellow.

Grown in gardens throughout the year.

Var. **arvense,** Poir. (*P. arvense*, L.). Field Pea. **Vern.** Desi Mattar (H) ; Batagadle (K) ; Kala Watana, Karain (G). *Stipules* large, ovate, semi-cordate, irregularly toothed at the base ; *leaflets* 4-6 : *peduncles* 1 or few-flowered, as long as or longer than the stipules ; *flowers* purplish, *standard* pink : *seeds* compressed, marbled.

A small field crop.

11. ARACHIS, L.

Herb with decumbent and erect stems : *leaves* equally pinnate ; *leaflets* usually in 2 pairs, exstipulate ; *stipules* adnate to the base of the petiole : *flowers* clustered in the axils of the leaves ; *calyx tube* filiform, *standard* suborbicular ; *stamens* usually monadelphous ; *ovary* with 2 or 3 ovules, after flowering becoming subterranean by the lenghtening of the peduncle : *pod* oblong cylindrical turgid, indehiscent reticulated, swollen slightly over the seeds ; *seeds* 1-3, irregularly ovoid, thick and fleshy.

1. **Arachis hypogaea,** L. Groundnut. Earthnut. Peanut. **Vern.** Bhuimug (M) ; Bhoising (G) ; Bhaimang, Nelagadle (K). *Stems* hairy, procumbent and branching : *leaflets* ovate : *flowers* yellow : *pod* 1 to 2 inches long ; *pericarp* tough, leathery, grey or brown, reticulated, dehiscent only by force ; *seeds* brown.

Classification and description of varieties :—

Class I.—Erect with pods clustered near roots and about 2 inches deep in ground ; early cropping 3 to 3½ months only : *leaves* comparatively larger or broader than in Class II : *pods* 2-seeded, short ; *husk* thin, closely fitting to seed ; *seed* small, rather round.

1. **Spanish peanut.**—*Leaves* darker than **Small Japan ;** *leaflets* broadly oval : *pods* hard to shell, constriction between kernel well pronounced ; *seeds* yellowish red.

2. **Small Japan.**—*Leaves* slightly yellowish tinted ; *leaflets* slightly crumpled, *margins* inclined to roll back : *pods* much less constricted between seeds ; *seeds* deep blood red or dark red coloured.

Class II.—Trailing and fruiting along the whole length of branches and pods 3 to 4 inches deep in ground ; late cropping 4 to 4½ months ; general appearance of a field darker than in class I : *leaves* narrower and slightly longer than in class I : *pods* 3-seeded ; *husk* loosely fitting to seeds ; *seeds* longer than in class I.

Sub-class A—Deshi of Poona or Local.—*Stems* trailing, very hairy, darker purple than others, more or less very closely sticking to the ground, one erect stem in centre and tips of trailing branches erect, fibrous to touch : *leaves* very hairy on lower surface, thinly and shortly hairy on upper surface ; *margins* rolled back ; *petioles* 30 to 40 mm. long, dark and hairy : *pods* 3-5-seeded, long, very corrugated.

Sub-class B—Foreign varieties.—*Stem* like that in Sub-class A but green and not so much hairy : *leaves* not hairy : pods usually thicker than in sub-class A.

1. **Big Japan.**—*Stem* stout, 7 to 8 per plant, one central erect and 2 to 4 sub-erect, branching laterally, thinly hairy : *leaves* glabrous on both surfaces, slightly rolled back at margins, broader than local ; *petioles* 40 to 50 mm. : *pods* largest of all, plump with thick husk. Plants similar to **Big Erect** are often found in this ; the latter is probably a selection from this.

2. **Pondicherry.**—*Stems* fibrous, 5-7, with many lateral branches with one central erect, purplish green, rather shorter and more spreading than **Virgina, Mozambique,** etc. : *leaves* glabrous, purplish green, inclined to roll back at margins ; *petioles* 40 to 50 mm. : *pods* often 2-seeded, shorter than others and reticulations not very clear.

3. **Egyptian.**—More vigorous than **Big Japan : *stems*** creeping, with 3 central ones, erect, green fibrous, hairy : *leaves* not hairy ; *margins* slightly rolled back ; *petioles* rather long, 40 to 50 mm., hairy.

4. **Queensland.**—*Stems* short, with 3 to 5 central erect branches, showing profuse axillary branching, even at lower nodes vegetative branches produced instead of flowers, spreading branches 7 to 9 : *leaves* rolled back at margins, glabrous ; *petioles* on erect branches, 30 to 40 mm. : *pods* large, long.

5. **Virginia creeper.**—One central *stem* erect with its two lower branches sub-erect, other branches rather longer than others : *leaves* bigger, lighter green and broader than **Pondicherry : *pods*** big, plump, with shells thinner than Big Japan, not adhering well to stems during digging ; *seeds* flesh coloured when green but light red in drying.

6. **Tamboo.**—*Growth* vigorous and light green in general appearance : one central *stem* erect with two lateral branches sub-erect.

7. **Mozambique.**—Generally indistinguishable from **Pondicherry :** one central *stem* erect : *leaflets* oval and broader than local.

8. **Big Erect.**—Spreading branches 7 to 9 and erect ones 1 to 5, fibrous to touch : *leaves* like Big Japan, many rolled back at the margins, glabrous ; *petioles* 30 to 40 mm., hairy.

The varieties known as **Mozambique, Mauritius, Madagascar** and **Pondicherry** are almost identical and are of the trailing type. The Brazilian types, the Java type, and those of Asiatic regions are all of the erect or bunch types.

Area.—In the year 1922-23 groundnut occupied 214,912 acres and stood third among oil seed crops. Of the total area under groundnut Satara grows 42·4 per cent., Sholapur 22·6 per cent., and Belgaum, Nasik and Poona about 8 to 9 per cent. The remainder is distributed between East and West Khandesh, parts of the Karnatak and Gujarat. The crop is grown both dry and irrigated. Groundnut is chiefly cultivated in the Western talukas of Satara, Poona and Nasik where most of the crop grown now consists of the early foreign varieties. Lately, the **Spanish peanut** variety is extending in Khandesh and in some parts of Gujarat such as to the north of Ahmedabad. **Big Japanese, Pondicherry, Spanish peanut** and **Small Japan** are the foreign varieties grown. Of these the **Spanish peanut** and **Small Japan** are the early varieties and are generally grown without irrigation. The other varieties are later though not so late as the country variety and require one or more waterings where the rainfall is scanty. Even these varieties are harvested about a month earlier than the country variety and in the Satara district even **Big Japanese** and **Pondicherry** are grown as dry crops in

the western talukas. An acre yields 800 lbs. of good fodder and 800 to 1,600 lbs. of unhusked nuts containing 65 to 75 per cent. of kernels.

12. CANAVALIA, Dc.

A large twiner, or erect shrub, smooth : *leaves* pinnately trifoliolate ; *stipules* linear, fleshy, persistent ; *petioles* steadily decreasing in length upwards, lateral *petioles* very short, terminal about 1 inch long ; *stipels* subulate, caducous ; *leaflets* subcoriaceous, terminal slightly the largest : *inflorescence* racemose, axillary ; *flowers* deep rose pink, fading blue, confined to the upper part of the rachis which is swollen at the base, solitary or in clusters of 2 to 3 from tubercles ; *pedicels* very short ; *bracts* and *bracteoles* very minute, ovate, scarious, caducous ; *calyx* tubular, slightly gibbous, limb bilabiate, the upper lip with two broad projecting lobes ; *petals* rather fleshy, *standard* orbicular emarginate, *disk* with two thick calli from which radiate bold lines which gradually fade into the slender nerves, the claw deeply concave, with two small incurved auricles at apex, *wings* appressed to keel, each with a large auricle, clawed, *limb* falcate, obtuse, *nerves* cohering into a white ridge downwards, *keel* petals similar to wings ; *stamens* almost monadelphous ; *anthers* versatile ; *ovary* shortly stalked ; *style* incurved ; *stigma* terminal, capitate : *pods* oblong, thick, distinctly ribbed on both sides of the upper suture.

1. **Canavalia ensiformis,** DC. Sword Bean. Jack Bean. **Vern.** Kadasambal (H) ; Abai (M) ; Shembi avare, Tumbekonji (K) ; Abao (G). *Leaflets* with rounded bases and shortly acuminate and apiculate tips, *nerves* 4 or 5 pairs, looping within the margins : *pedicels* $\frac{1}{8}$ inch long ; *calyx* $\frac{5}{8}$ inch long and $\frac{3}{8}$ inch broad ; *corolla* 1 to $1\frac{1}{2}$ inch long : *pods* varying greatly in length, but usually from 6 to 12 inches with a breadth of 1 to 2 inches ; *seeds* 7 to 12, red, 1 inch by $\frac{5}{8}$ inch.

A large climber of perennial duration grown near houses and on trees and hedges throughout the year, over the whole Presidency for the sake of its seeds and pods which are eaten as a vegetable. The variety **Virosa** is extremely abundant as a wild plant in the Konkan and it only differs from the type in being more hairy and by bearing uneatably nauseous pods and greyish-brown seeds.

Var. **fruticosa. Vern.** Pandhri abai (M). An erect shrub, $3\frac{1}{2}$ feet high : *leaflets* 3 to 4 by 2 to $2\frac{1}{2}$ inches, coriaceous : *flowers* on short lateral racemes ; *calyx* $\frac{5}{8}$ inch ; *corolla* pink purple, 1 by $\frac{3}{4}$ inch : *fruit* 10 to 11 inches long by 1 inch broad ; *seeds* white, $\frac{3}{4}$ by $\frac{1}{4}$ inch.

Grown in gardens during the rains, principally in the Deccan and Khandesh.

13. PHASEOLUS, L.

Herbaceous twiner : *leaves* pinnately trifoliolate, stipulate and stipellate : *flowers* in racemes, bracteate and bracteolate ; *calyx* campanulate with unequal teeth ; *corolla* exserted, *keel* beaked and forming a more or less complete spiral ; *stamens* diadelphous ; *anthers* uniform ; *ovary*

sessile, many-ovuled ; *style* filiform, twisted round the keel, bearded below the very oblique stigma : *pods* linear or oblong, more or less distinctly septate between the seeds.

Stipules basifixed.

Pods scimitar shaped, 2-4-seeded : *flowers* small, greenish .. .. 1. **P. lunatus.**

Pods linear, straight, 4-6-seeded : *flowers* medium-sized, lilac or white .. .. 2. **P. vulgaris.**

Stipules peltate : *corolla* yellow : *pods* cylindrical.

Leaflets deeply lobed : *pods* smooth .. 3. **P. aconitifolius.**

Pants erect : *leaflets* not deeply lobed, yellowish green : *pods* spreading .. 4. **P. Mungo.**

Plants diffuse : *leaflets* not lobed, yellowish green : *pods* ascending ; *seeds* larger .. 5. **P. radiatus.**

1. **Phaseolus lunatus,** L. Lima Bean. Double Bean. Rangoon Bean. A tall twiner, uniformly clothed with shortly pilose hairs : *leaves* long petiolate ; *stipules* small, triangular, basifixed on rather broad bases ; *stipels* elliptic ; *basal leaflets* dimidiately ovate, shortly and obtusely acuminate, broadly truncate at base ; *terminal leaflet* equally ovate, obtusely acuminate tapering from a broad truncate base : *flowers* in short racemes on secondary branches ; *bracts* similar to but smaller than the stipules ; *bracteoles* smaller, broadly ovate ; *pedicels* slender, short, becoming thicker and a little longer in fruit ; *calyx* $\frac{1}{10}$ inch long, gibbously campanulate, teeth short, two upper rounded, the three lower acute ; *corolla* $\frac{3}{4}$ inch long, *standard* green with a purple suffusion reniform, emarginate, with two incurved auricles at base, basal half of *limb* thickened and convex, apical half membraneous and concave, *wings* obovate, pink suffused with yellow at base, which is slightly auricled with a short slender claw, *keel* white, suffused with green, about one-third the length of the wings, prolonged into a complete tight spiral : *pods* up to 5 inches long and 1 inch broad, oblong falcate, tapering to base, apex with a recurved tip, *ventral suture* green, smooth, *dorsal suture* thicker, often warted ; *seeds* 2 to 4, compressed, 1 inch long by $\frac{3}{4}$ inch broad, variable in colour, usually white, marbled and spotted with pink.

Var. novo. **glabra,** differs from the type in all parts being smooth, the *flowers* smaller and more numerous, *standard* green, *wings* white, fading, to yellow, *keel* white : *pods* smaller, $2\frac{1}{2}$ inches by $\frac{3}{5}$ inch, more inflated ; *seeds* dull white, $\frac{4}{5}$ by $\frac{1}{2}$ inch.

Cultivated throughout the Presidency for the sake of the young pods, or at a later stage the large seeds. The plant is biennial and is said to be a native of Brazil.

2. **Phaseolus vulgaris,** L. French Bean or Kidney Bean. **Vern.** Shravan Ghevda (M) ; Tingalavari (K). In its most usual form (as seen in India) a sub-erect, almost smooth annual : *racemes* shorter than the

leaves, lax, few-flowered ; *bracteoles* ovate, persistent ; *flowers* lilac or white : *pods* 4 to 6 inches, linear, straight, turgid, smooth.

Cultivated throughout the year in gardens for its green pods which are used as a vegetable.

3. **Phaseolus acontifolius.** Jacq. **Vern.** Moth (H) ; Math (G) ; Math (M) ; Madiki (K) ; Mohar, Muhri (S). *Stems* slender, 2 to 3 feet long, diffuse, slightly hairy : *leaflets* pedately tripartite ; *lobes* linear oblong acute ; *stipules* lanceolate, ribbed pilose : *peduncles* long hairy ; racemes capitate ; *bracteoles* linear, longer than the calyx ; *flowers* minute : *pods* up to 2 inches long, about 6 seeded ; *seeds* small oblong brownish.

A rains crop. Mollison (12) says that this pulse is fourth in importance in Bombay, and that it is grown to a considerable extent in all districts, except the Konkan. The most important districts are Ahmedabad, Kaira, Khandesh, Ahmednagar, Poona, Sholapur, Dharwar, Belgaum and Bijapur.

4. **Phaseolus Mungo,** L. Green Gram. **Vern.** Mag (G) ; Mug (M) ; Hesaru (K) ; Mung (H) ; Ma (S). Two to three feet high : *stem* cylindrical up to first node, smooth upwards with the branches and petioles of leaves angular and furrowed, all parts with a brown suffusion and thinly covered with lax, coarse grey and brown hairs : *leaves* petiolate, stipulate and stipellate ; *petioles* rising from the main stem, very robust, decreasing from 6 to 2 inches upwards ; *stipules* fixed by the centre, rhomboidal, ciliate ; *stipels* falcately lanceolate acuminate, the upper leaflet with two pairs ; *basal leaflets* with thick petioles, $\frac{1}{4}$ inch long ; *blade* 4 by $3\frac{1}{2}$ inches and more in luxuriant examples, dark green, flaccidly membranous, bullate, unequal, palmately veined, very broadly ovate acute, base truncate, veins and veinlets brown ; *terminal leaflets* usually smaller than the basal, equally and broadly ovate acute ; *petioles* and *leaflets* on the branches smaller in all their parts : *inflorescence* of capitate racemes from the upper axils of the main stem and branches, the uppermost overtopping the plant ; *peduncles* of main stem decreasing in length upwards from 5 to 2 inches the three or four at the top not subtended by leaves ; *peduncles* on the branches more slender and shorter ; *bracts* similar to the stipules ; *flowers* subsessile, pale yellow, often suffused with smoky brown ; *bracteoles* half as long as the calyx ; *calyx* small, gibbously campanulate, 5-lobed ; *corolla* $\frac{1}{2}$ inch long, *standard* $\frac{1}{2}$ inch broad, reniform and retuse, *disk* with a slightly thickened callus, *claw* very short, with a small triangular tooth on each side, *wings* oblique, falcately oblong, claw at right angles to the limb 2-lobed at base, *keel* strongly falcate lanceolate but not spiral, *tip* obtuse ; *stamens* diadelphous ; *filaments* rather long, filiform, curved ; *anthers* equal, yellow ; *ovary* minutely strigose : *style* long, slender, curved, bearded for a short distance below the pointed stigma : *pods* horizontally spreading, 2 to 3 inches long, $\frac{3}{8}$ inch broad, cylindric, sub-torulose, surface black thinly covered with greyish brown coarse hairs, apex pointed, *sutures* rather thick ; *seeds* about 12, separated slightly by white, thin, pity, transverse septa, usually with minute white hairs on the testa which varies in colour, average length and breadth $\frac{1}{16}$ by $\frac{1}{5}$ inch.

This is usually grown as a kharif crop which ripens at the end of the rains. Mr. Mollison (12) says it is also grown as a rabi crop after rice in Dharwar, Kolaba and Kanara and that this pulse is sixth in importance in Bombay.

The chief centres of cultivation are in Dharwar and Bijapur, the other more important centres are Ahmedabad, Khandesh, Ahmednagar, Satara and Belgaum.

There are a number of varieties of the type which differ more from each other in the colour of the seeds than by any outwardly tangible character. The prevalent colour is yellowish brown with a white hilum and the shape ellipsoidal with slightly truncate ends. They may also be olive green, bright green, and greenish black. They vary in weight from 300 to 500 per tola. A variety from the Akola Taluka in Ahmednagar differs in the leaves being yellow with light coloured veins like those of the next species.

Cooke (3) in his Flora of Bombay records two varieties (var. **aureus** and var. **grandis,** Prain) in the Bombay Presidency which have not come under the present writer's notice.

Var. Novo **surattensis.** A plant attaining 10 inches in height, hirsute, with a dark-brown tinge : *stem* simple or with only two spreading branches near the base, 5-6 angled : *petioles* successively shortened upwards in such a way that the five leaves usually form a rosette ; *leaflets* up to 9 inches long and 8 inches broad, panduriformly 3-lobed, midlobe obtuse ; *cotyledonary leaves* persistent, 2½ inches long, entire ovate oblong, obtuse, *base* slightly cordate, 3-nerved : *peduncles* curved, about 3 inches long : *seeds* in each pod about 10, green, *hilum* white.

This variety is very inferior and seems to have been only grown to any extent in the Surat District as a make-shift during the famine years of 1899 and 1900.

5. **Phaseolus radiatus,** L. **Vern.** Urid (H) ; Udid (M) ; Uddu (K) ; Adad (G). A plant superficially resembling the last in many respects and best distinguished from it by differential characters. Plants attain the height of 3 feet : *stems* and other parts with a decidedly light green colour : *leaflets* more coriaceous, acuminate, veins pale ; *stipules* narrow and more pointed : *inflorescence* arising from almost every axil and the uppermost not overtopping the plant ; *bracteoles* twice as long as the gibbously campanulate slightly toothed or almost truncate calyx, *callus* on the *standard* produced into a tooth : *pods* linear oblong, compressed, black, densely covered with coarse, brown, spreading hairs, 2½ inches long by ¼ inch broad, *sutures* indistinct ; *seeds* 6, black, mottled with light brown, ¼ by 3/16 inch, *hilum* raised, white.

According to Mollison (12) this is usually grown in the kharif season or in the rabi after rice. He says it is an important pulse in the black soils of Khandesh and that it is also grown fairly extensively in Nasik, Satara, Belgaum, Thana and Ahmedabad. In other districts it is of minor importance.

14. **VIGNA,** Savi.

Annual scandent or suberect plants : *stems* sulcate, quite smooth, excepting at the nodes which are white hairy : *leaves* pinnately trifoliolate, stipulate and stipellate ; *stipules* fixed just above the base ; *petioles* long ; *leaflets* slightly succulent, dark green and minutely white punctate above, light green beneath, *lateral leaflets* with short, thick, thinly hairy stalks ; *blades* dimidiately rhomboidal ovate acute, 3-nerved at base which is cuneate or subtruncate or slightly cordate, *blade* of terminal leaflet with a longer stalk and equally ovate accute or obtuse ; *stipels* small, ovate obtuse succulent : *inflorescence* in capitate racemes which rise from almost every node ; *peduncles* as long as or much shorter than the leaves, the flowering part nodose, white and 3-6-flowered ; *flowers* subsessile, about 1 inch in diameter ; *calyx* with a transversely rugulose surface, slightly gibbously campanulate, *limb* 5-partite, *lobes* subequal, lanceolate acute, *standard* orbicular retuse with a deep yellow longitudinal fold, *claw* short, thick, with a falcate lobe on each side, lower part of *disk* with two narrow callosities and a yellow blotch, *wings* falcately oblong with rounded apices, *claw* curved slender, *keel* white, falcately ovate, *tip* rounded, *claws* short ; *stamens* diadelphous ; *ovary* narrow, minutely white hairy ; *style* curved, penicillate on the lower side for some distance beneath the dark green obliquely capitellate *stigma* which has a small yellow lobe on the upper side : *pods* linear, ascending, greenish-white, lanceolate ; *endocarp* and the imperfect transverse dissepiments white pithy ; *seeds* varying in size and colour.

1. **Vigna catjang,** Walp. Cow pea. **Vern.** Lobia (H) ; Chavali (M) ; Alsandi (K) ; Chola (G) ; Chaunro (S). As above. Suberect plant with *pods* varying in length from four inches to two feet.

In Marathi the name Alsandi is applied to the large seeded and chavali to the small seeded. The cultivation of this pulse is not extensive. It is grown to the greatest extent in the Kaira, Khandesh, Belgaum, Bijapur and Thana Districts. It is grown in the kharif and also, after rice, in the rabi season.

Of this plant there are two, and perhaps three varieties, distinguished readily by the manner of growth and the size of the seeds.

Sub-var. A. Red Chavali of Poona. *Branches* short and congested : *leaflets* large, membranous : *flower* pale yellow : pods $5\frac{1}{2}$ inches long ; *seeds* 12 to 18, dull red, rounded, black around hilum, $\frac{3}{8}$ inch by $\frac{1}{4}$ inch.

Var. **sinensis** (*V. sinensis*, Endl.) differs from the type in being scandent and in Bombay is by far the commoner form.

Sub-var. A. *Pods* pendulous, $1\frac{1}{2}$ foot long, by $\frac{1}{2}$ inch broad ; *seeds* 21, remote, dull red, flat, $\frac{1}{2}$ by $\frac{1}{4}$ inch.

Sub-var. B. Scandent, rather small in all its parts : pods $5\frac{1}{2}$ by $\frac{1}{4}$ inches ; *seeds* 12 to 18, rounded, dull red, black round hilum, $\frac{3}{8}$ by $\frac{1}{4}$ inch.

Sub-var. C. Chavali. Small in all its part : *stems* scarcely furrowed : *pods* 4 inches by 3/16 inch ; *seeds* very closely arranged, about 13, dark red, drab or white, $\frac{3}{8}$ by $\frac{1}{4}$ inch.

Sub-var. D. *Seeds* creamy white, with a broad black band around hilum, $\frac{3}{8}$ by $\frac{1}{4}$ inch.

Sub-var. E. The common variety in the Presidency. *Flowers* violet with a crimson suffusion : *pods* about 5 inches by $\frac{1}{4}$ inch ; *seeds* $\frac{1}{4}$ by 3/16 inch, ellipsoid, light brown, *hilum* white encircled with black.

Sub-var. F. From Ratnagiri and Bijapur, small in all its parts including the pods : *seeds* very closely arranged 9 to 13, $\frac{1}{4}$ by 3/16 inch, uniform drab in colour.

Sub-var. G. *Pods* short ; white seeded ; *seeds* $\frac{1}{4}$ by 3/16 inch, creamy with a purple suffusion around the white hilum.

Sub-var. H. *Pods* short ; *seeds* 15, dull red, black and drab $\frac{1}{4}$ by $\frac{1}{8}$ inch.

15. DOLICHOS, L.

Twining or suberect herbs : *leaves* pinnately trifoliolate ; *stipules* and *stipels* small : *flowers* axillary, racemose or fascicled ; *bracts* and *bracteoles* small, caducous ; *calyx* campanulate, teeth usually short, the upper pair more or less connate ; *corolla* much exserted, *standard* with inflexed auricles at the base, *keel* obtuse or rostrate, not spiral ; *stamens* diadelphous ; *anthers* uniform ; *ovary* subsessile ; *ovules* many ; *style* filiform or thickened upwards, bearded down the inner face or penicillate at the apex ; *stigma* terminal : *pod* flat, linear or oblong, recurved.

Style thickened, bearded along the inner face : *pod* oblong .. .. 1. **D. Lablab.**

Style filiform, penicillate round the stigma : *pods* linear oblong .. .. .. 2. **D. biflorus.**

1. **Dolichos Lablab,** L. **Vern.** Pavata, Ghevda (M) ; Avare (K) ; Val (G) ; Wall (S).

This has to be considered along with its var. **lignosus.** In the first, the pods taper to the apex and the seeds are parallel with the surfaces, in the second the pods are abruptly truncated and the seeds lie at right angles or at least obliquely to the sutures.

Pods narrow, tapering to the apex ; *seeds* parallel to the sutures .. .. 1A. **Dolichos Lablab,** L.

Pods broad, abruptly truncated ; *seeds* at right angles or obliquely placed to the sutures .. .. .. 1B. **D. lablab,** L., *var.* **lignosus,** Prain.

1A. **Dolichos lablab,** L.

Scandent with scabrid pubescence : *flowers* white fading to yellow ; *peduncles* as long as *petioles* : *pods* $4\frac{1}{2}$ inches by $\frac{1}{2}$ inch, not compressed .. **Var. 1. White flowered Ghevda.**

Sub-erect, densely and softly pubescent : *petioles* and *peduncles* short : *pods* oblanceolate .. .. .. **Var. 2. Pavata.**

1B. **Dolichos Lablab,** L. *var.* **lignosus,** Prain.

Scandent with scabrid pubescence: *shoots* suffused with purple: *peduncles* about 2½ inches long; *flowers* purple: *pods* 3 inches by 1 inch	**Var. 1. Ghevda, No. 1.**
As in the last, but all parts more robust: *pods* strongly suffused with purple ..	**Var. 2. Kathiavadi Ghevda.**
Scandent with scabrid pubescence: *shoots* only slightly suffused with purple: *racemes* subsessile; *flowers* reddish purple, *wings* of *corolla* much broader than in any other variety: *pods* 2 inches by 1½ inch ..	**Var. 3. Ghevda, No. 2.**
Trailing in fields, pubescence scabrid: *flowers* yellow; *peduncles* long: *pods* 2 inches by ½ inch	**Var. 4. Ghevda, No. 3.**
Trailing in fields, all parts covered with a dense short pubescence: *petioles* and *peduncles* very long; *flowers* pale yellow: *pods* 2 inches by ¾ inch	**Var. 5. Kadva.**
A twiner: *leaves* moderately small: *flowers* dark blue: *pods* 4 inches by 1¼ inch ..	**Var. 6. Ghevda (Poona)**

1A. **Dolichos Lablab,** L.

Var. 1. White flowered Ghevda. A strong annual twiner: *shoots* terete, scabrous with minute hairs as are all parts of the plant: *leaves* pinnately trifoliolate; *stipules* nerved, small, triangular, with decurrent bases; *petiole* slender, as long as the lower leaflets; *petiolules* ¼ inch long, white hairy; *stipels* more conspicuous than stipules, lanceolate, *lateral leaflets* rhomboidal ovate acuminate, membranous, base broad once repand on the lower side; *nerves* from base 3; *terminal leaflet* as in the lateral but with base distinctly cuneate: *inflorescence* from primary and secondary axes; *peduncles* from ½ to ⅔ as long as petioles; *flowers* rising in small clusters (usually in pairs) from tubercular thickenings; *bracts* minute, caducous; *bracteoles* one-third shorter than calyx oblong scarious, caducous; *flowers* subsessile, white, fading to pale yellow, ¾ inch long; *calyx* ¼ inch long, gibbously campanulate, mouth white ciliate, *upper lip* emarginate with two cohering lobes, *lower lip* with three narrow spreading lobes, *standard* ¾ inch broad, slightly retuse, shortly clawed and auricled with two raised calli projecting on the disk to within two-thirds from the apex, *wings* as long as keel and about equal to it, *keel* curved through a right angle; *stamens* diadelphous; anthers uniform; *ovary* sessile, green; *style* thickened upwards white, penicillate below the capitate stigma: *pods* not flattened curved 4½ inches by 1½ inch, surface white streaked, *sutures* rather rough with raised projections; *seeds* 4, parallel to sutures.

Cultivated extensively in the Konkan, for example, at Bassein, whence the pods are exported to Bombay.

Var. 2. Pavta, Val (Poona District). A suberect plant, all parts, excepting the corolla and pods, densely and softly pubescent: *petioles* 3 to 4 inches: *peduncles* 3 inches or less; *flowers* closely arranged, almost white: *pods* not falcate, almost oblanceolate in shape, scarcely compressed, $1\frac{1}{2}$ inch long by $\frac{3}{8}$ to 1 inch broad; *seeds* 3 to 4, small, white, parallel with the sutures.

Cultivated in the Konkan in fields as a rabi crop following rice, both as a vegetable and for green fodder. Owing to its somewhat unwholesome properties it is not held in esteem.

1B. **Dolichos Lablab.** L., *var.* **Lignosus,** Prain.

Var. 1. Ghevda, No. 1. Bandval (Konkan). Scandent: *shoots* scabrid, suffused with purple: *leaflets* large, flaccid: *racemes* only about $2\frac{1}{2}$ inches long; *flowers* blue: *pods* 3 inches by 1 inch, strongly compressed; *seeds* 4 at right angles to the sutures.

This is the largest and strongest variety growing in the Konkan.

Var. 2. Kathiavadi Ghevda. As in the last, but all parts more robust: *pods* strongly suffused with purple, especially on the sutures.

Seen only at Bassein in the cold season.

Var. 3. Ghevda, No. 2. Lalgunj (Bassein). Strongly twining: *shoots* covered with scabrid pubescence: *petioles* short, often not more than an inch long: *racemes* subsessile; *flowers* reddish purple, clustered on a thickly tuberculated rachis, $\frac{5}{8}$ inch in diameter, *calli* on *disk* of *standard* strongly developed, *wings* much broader than the keel which is white, teeth of calyx all short: *pod* 2 inches by $\frac{1}{2}$ inch, compressed; *seeds* 2 to 4.

Var. 4. Ghevda, No. 3. Val Papadi (Konkan). A trailing plant of the fields in the rabi season: *petioles* 2 to 3 inches long: *peduncles* about 6 inches long; *flowers* yellow: *pods* falcate, 2 inches by $\frac{1}{2}$ inch, compressed; *seeds* 4.

Var. 5. Kadva. Trailing plant in fields, lower part of stem woody, all parts, excepting the corolla and pods, densely and softly pubescent: *petiole* 4 to 6 inches long: *peduncles* 5 to 7 inches long; *calyx* very shortly campanulate; *corolla* pale yellow, with a white *keel*, $\frac{1}{2}$ inch in diameter: *pods* 2 inches long by $\frac{3}{4}$ inch broad, strongly falcate; *seeds* 3.

Largely cultivated after rice in the rabi season in the Konkan and in other parts where rice is grown.

Var. 6. Ghevda (Poona). A lax tall climber: *stems* slender, green: *leaves* moderately small, only slightly hairy: *peduncles* long; *flowers* dark-blue: *pods* very large, 4 inches by $1\frac{1}{4}$ inch.

Our knowledge of the distribution of all these varieties is very incomplete and much remains to be done.

2. **Dolichos biflorus,** L. (*D. uniflorus*, Lamk.). HORSE GRAM. **Vern.** Kulthi (H); Kulthi (G); Hulga (M); Hurali, Hurli (K); Kulitha,

gagli (S). Shortly scandent, 18 inches high, all parts grey pilose : *stems* slender, terete ; *branches* many from the base, sharply ascending : *leaves* petiolate, stipulate and stipellate, pinnately trifoliolate ; *stipules* lanceolate acute, $\frac{3}{8}$ inch long, from a broad base ; *petioles* concave, about 2 inches long ; *leaflets* yellowish green, membranous paler beneath, palmately 3-nerved, *lateral leaflets* $1\frac{3}{4}$ by 1 inch, obliquely ovate acute, mucronate, *terminal* as large, equally elliptic acute ; *stipels* subulate : *racemes* arising from the axils of most of the leaves : *peduncles* red, $\frac{1}{4}$ inch long ; *bracts* short ; *bracteoles* as long as the tube of the calyx ; *flowers* cream coloured, $\frac{3}{8}$ inch long ; *calyx* one-third, shorter than the corolla, equally 4-partite, segments linear lanceolate acuminate, *standard* elliptic oblong, $\frac{3}{8}$ by 3/16 inch, *claw* subobsolete, green, *central callus* oblong, half as long as the blade, with a pink spot at its upper end, *wings* linear retuse twisted, very shortly clawed, *keel* slightly falcate obtuse ; *stamens* diadelphous ; *anthers* subequal ; *ovary* and *style* white pilose, the latter thinly so ; *stigma* capitate : *pod* linear falcately oblong, tipped by the persistent style and subtended by the persistent calyx, compressed $1\frac{1}{2}$ by $\frac{1}{4}$ inch, surface thinly pilose ; *seeds* 5, showing through the pericarp, *cells* with hyaline partitions ; *seeds* dark or light red, flattened, ellipsoid, $\frac{1}{4}$ by $\frac{1}{8}$ inch.

Var. a. White Kulthi. *Seeds* creamy white, mottled with dark red, 3/16 by $\frac{1}{8}$ inch.

In Gujarat, Ahmedabad grows a small area. The cultivation is very important in the Deccan, particularly in Khandesh, Nasik, Ahmednagar and Satara. It is also grown in Belgaum, Bijapur and Dharwar. In the Konkan the pulse is of importance only in Ratnagiri. It is usually grown in the kharif season but occasionally also in the rabi.

16. PSOPHOCARPUS, Neck.

Twining herb, with large tuberous roots : *leaves* pinnately trifoliolate ; *stipules* lanceolate, fixed above the base ; *leaflets* ovate : *flowers* rather large, lilac, on lax racemes ; *bracts* small, caducous ; *bracteoles* larger, ovate, persistent ; *calyx* campanulate, teeth shorter than the tube, the two upper connate ; *corolla* exserted, *standard* suborbicular, *wings* obovate, *keel* obtuse, incurved at apex ; *stamens* monadelphous, the upper free downwards ; *anthers* uniform ; *ovary* shortly stalked, with many ovules ; *style* long, much recurved, laterally compressed, densely bearded round the terminal globose stigma : *pod* square, with a distinct wing to each angle, septate between the *seeds* which are transversely oblong.

1. **Psophocarpus tetragonolobus,** DC. CHEVAUX DE FRISE BEAN : **Vern.** Chavdari Ghevda (M). *Leaflets* broad, with subdeltoid bases : *pods* 6 to 9 inches long : *wings* up to $\frac{1}{4}$ inch broad, usually much crisped and toothed.

Cultivated in gardens as a vegetable during the rainy season.

17. GLYCINE, L.

Erect, brown hairy bushy annual about 1½ to 2 feet high : *leaflets* 3, ovate to narrow ovate, 3 inches long, entire, apiculate with small free stipels : *flowers* small, white to purplish, in short axillary racemes ; *calyx* hairy, 2 upper teeth more or less united ; *standard* broad somewhat auricled at base, *wings* lightly adherent to the short obtuse keel ; *stamens* mostly monadelphous ; *style* beardless ; stigma small, terminal : *pods* narrow, flat or with convex sides, with constrictions between the seeds, hanging by short stalks, 2-3 inches long by ½ broad, brown hairy ; *seed* 2-4, globose, green, brownish yellow, or black with small hilum.

1. **Glycine Max.** Merr. (*G. Soja*, Sieb. & Zucc.). SOY-BEAN.

Occasionally cultivated on Government farms. Useful as a forage and oil-yielding plant.

18. CAJANUS, Dc.

A woody shrub, cultivated as an annual, but really perennial in its nature, uniformly clothed with minute pubescence : *stems* green, slightly ridged : *leaves* pinnately trifoliolate ; *stipules* small, ovate lanceolate, with a thick median nerve ; *stipels* filiform ; *leaflets* oblong lanceolate, tapering to both ends, subcoriaceous, lower surface minutely gland dotted : *flowers* in axillary, corymbose racemes longer than the leaves ; *pedicels* 3-5 inch long, slightly lengthening in fruit ; *bracts* similar to the stipules, caducous ; *bracteoles* absent ; *calyx* campanulate, teeth short, each one-nerved the two upper subconnate, the three lower spreading ; *standard* obovate, emarginate, shortly clawed, and with two inflexed auricles at base, *wings* obliquely obovate, clawed, *keel* obtuse, with an incurved tip ; *stamens* diadelphous ; *anthers* uniform ; *ovary* subsessile ; ovules few ; *style* long, beardless ; *stigma* obliquely capitate : *pod* linear, oblong, acute at both ends, continuous within, *valves* with oblique depressed lines between the *seeds*, which are 2 to 5, compressed and very variable in *colour*.

1-A **Cajanus cajan,** Millsp. (*C. indicus*, Spreng.), var. **flava.** PIGEON PEA. **Vern.** Tur (H) ; Tur (M) ; Togari (K) ; Tuvar (G). A much branched shrub : *leaves* seldom more than 3 inches long and 1 inch broad : *inflorescence* terminal or confined to the upper parts of the spreading twigs ; *calyx* 2-5 inch long ; corolla 7-10 inch long, bright yellow : pods 1¾ inch long by 3-10 inch broad, densely glandular pilose, lines green purple over to the seeds in unripe fruits.

The most prevalent form in the Bombay Presidency.

1-B **Cajanus cajan,** Millsp. (*C. indicus*, Spreng.), var. **bicolor. Vern.** Arhar (H). Sparsely branched : *leaves* often 3½ inches long and 1½ inch broad : *inflorescence* arising from the axils of all the short, strict, twigs ; *racemes* usually paired ; *calyx* 3-5 inch long ; *corolla* 7-10 inch long, *standard* yellow blotched and veined with purple on the back, *wings* slightly purple at base, *keel* greenish : *pods* 2½ inches long by 3-5 inch broad, green and broadly streaked with purple when ripe.

This form probably only occurs in Gujarat. With the exception of the Konkan, **C. Cajan,** Millsp., is an important crop in every district of the Presidency, being sown in the kharif season usually with other crops and ripening in the rabi season.

Pollination. In the bud stage the anthers surround the stigma and burst the day before the flower opens and a dense mass of pollen is distributed all over the stigmatic surface. Flowers set seed under bags also. Experiments have shown that natural crossing is common.

15. ROSACEÆ

Herbs, shrubs or trees : *leaves* alternate, simple or compound, stipulate : *flowers* regular ; *calyx* tube free or adnate to the ovary ; *limb* usually 5-lobed ; *petals* usually 5, inserted under the margin of the disk, deciduous, usually imbricate ; *disk* lining the calyx tube or forming a ring at the base ; *stamens* perigynous, indefinite ; *ovary* of one or more free or connate carpels, with free or connate styles ; *styles* basal, lateral or subterminal ; *ovules* one or more in each carpel : *fruit* usually indehiscent, of clustered achenes or drupels or single drupes ; *seeds* exalbuminous, *embryos* with large flat fleshy cotyledons.

Shrubs with compound leaves : *carpels* many ; *styles* ventral or basal : *fruit* of many small fleshy carpels (drupels)	1. **Rubus.**
Herb : *carpels* many : ripe *fruits* consisting of small achenes scattered on a swollen fleshy thalamus	2. **Fragaria.**
Shrubs with compound leaves : *flowers* regular ; *calyx* tube urceolate ; *petals* 5 ; *stamens* very numerous ; *carpels* many, free ; *ovules* pendulous : *achenes* included in the fleshy calyx tube	3. **Rosa.**

1. RUBUS, L.

An erect prickly shrub : *leaves* 5-9 foliolate : *flowers* in terminal and axillary corymbs ; *petal* pink : *drupels* numerous, almost black when ripe.

1. **Rubus lasiocarpus,** Smith. BLACK RASPBERRY. (Mahableshwar). RASPBERRY. **Vern.** *Gauriphal* (M). Young shoots covered with white tomentum : *leaflets* dark green above, covered beneath with white woolly tomentum : *petals* pink, orbicular or broadly obovate ; *carpels* tomentose ; *style* red : *fruit* $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter.

A wild plant at Mahableshwar and other places on the Ghats. It is cultivated at the former place and the fruit sold for eating and for making into jam. The plant grows well in Deccan gardens but it rarely produces fruit. The fruits ripen in the hot weather.

2. FRAGARIA, L.

Perennial herb with creeping stolons : *leaves* digitately trifoliolate : *flowers* white ; *calyx* persistent with 5 bracteoles at the base ; *lobes* 5 ; *stamens* indefinite ; *carpels* many on a convex receptacle ; *style* ventral ; *ovule* one : *achenes* many, minute, sunk in the surface of a convex fleshy receptacle.

1. **Fragaria vesca,** L. STRAWBERRY. *Leaflets* sessile or almost so, many-toothed : *fruits* red, globose or bluntly conical.

There are two varieties : one large leaved with large fruits, and the other with smaller leaves and fruits.

Cultivated to a considerable extent at Mahableshwar where its fruits ripen from March up to the commencement of the rains in June. It is sometimes grown in the Deccan where success is only attained by extreme care.

3. ROSA, L.

Erect sarmentose or climbing shrubs usually prickly : *leaves* pinnate ; *leaflets* serrate ; *stipules* adnate to the petiole : *flowers* terminal, solitary or corymbose, white, yellow or red ; *bracts* rarely persistent ; *calyx* tube persistent, globose ovoid or pitcher-shaped, mouth contracted ; lobes leafy, imbricate in bud ; *petals* 5, large ; *stamens* many inserted on the disk ; *disk* coating the calyx tube, all but closing its mouth by its thickened margin, silky ; *carpels* many, rarely few, in the bottom of the calyx tube ; *styles* subterminal, free or connate above ; *stigma* thickened ; ovule 1, pendulous : *achenes* coriaceous or bony, enclosed in the fleshy calyx tube.

Distribution. North Temperate regions, rare in America ; extending into Abyssinia, and Mexico ; species of about 30 very distinct forms with innumerable subspecies and varieties.

The rose is cultivated in every garden in India. The varieties cultivated in the Bombay Presidency number about seventy and many of them are old roses which have gone out of fashion or taste of growers in foreign countries where new varieties are being developed every year.

In the Bombay Presidency some locally reputed varieties are cultivated in garden lands for commercial purposes in places like Poona, Dharwar, Belgaum, Ahmedabad, Surat and in the suburban areas of Bombay. These are usually hardy, free flowering and blooming at the time when flowers are required by the market, especially in seasons of festivals.

The following are some of the varieties of roses :—

Belle Lyonnaise. *Flowers* deep canary yellow, tinged with salmon, large and full.

Devoniensis. *Flowers* creamy white, centres sometimes buff and sometimes yellowish.

Gloire de Dijon. *Flowers* rose shaded with salmon very large and full.

Homer. *Flowers* white tinted with rose and fawn, small not opening broad, abundant bloomer.

Lamarque. *Flowers* lemon in bud, opening to white : *leaves* very pointed.

Marechal Niel. *Flowers* beautiful, deep yellow gold colour large, full globular, strong scented ; good bloomer.

Edward Rose. *Flowers* pink, globular and cup shaped, free bloomer all the year round.

Lavenir. *Flowers* flesh coloured, margins almost white, abundant bloomer ; middle petals rolled, compact and thick.

La France. *Flowers* double, beautiful, pale peach colour, rose centre, large and full, very free bloomer ; a fine decorative and extra fragrant rose.

All varieties are propagated by budding or by layers and cuttings for supply of plants to bungalow gardens.

Pyrus Malus, L. Apple. **Vern.** Seb safargang (H) ; Safarchand (M) ; Kittale, Servu (K).

Pyrus communis. L. Pear. **Vern.** Naspati.

Prunus Amygdalus, Baill. Almond. **Vern.** Badam (G, M, K, H).

Prunus persica, Benth. Peach. **Vern.** Aru (H).

Eriobotrya japonica, Lindl. Loquat. **Vern.** Lokat.

All these belong to the family Rosaceæ. These plants are occasionally found planted in gardens with the exception of loquat. They do not fruit well. Large quantities of these fruits, especially the apple, are imported into this Presidency from north-western Himalayan tract and other places.

The loquat tree grows well, flowers abundantly in June and July and ripe fruits can be had in December. The fruit is not of as large a size as attained in upper India. Though liked by some it is neglected by the general public.

16. MYRTACEÆ

Small tree : *leaves* opposite, entire : *flowers* regular hermaphrodite, on axillary, short, 1-3 flowered peduncles ; *calyx* top-shaped ; *limb* 4-5-lobed often persistent ; *petals* white, 4 or 5 ; *stamens* indefinite ; *ovary* inferior, crowned by a flat disk, 2 or more-celled, each cell with many ovules : *fruit* a many-seeded berry ; *seeds* with a bony testa.

1. PSIDIUM, L.

As above.

1. **Psidium gujava**, L. Guava. **Vern.** Peru (M) ; Peral hannu or shebe hannu (K) ; Famrukh (G) ; Amrut (H) ; Zaitun (S). A small tree : *leaves* very shortly petioled, ovate or oblong, softly hairy beneath, principal nerves prominent ; *peduncles* short ; *fruit* globose or pearshaped,

This tree, originally a native of South America, is not only cultivated but has naturalised itself with great freedom throughout the country. No fruit probably varies so much in value and quality and this is in a great degree due to the custom of raising plants from seeds. Good results can only be obtained by grafting.

Guavas are grown to a large extent in this Presidency. The places of repute are Kothrud (Poona), Nasik, Satara, Dholka, Baroda and Dharwar. Recently seedless forms have been introduced from Agra and Allahabad. Grafts of seedless types are offered for sale on the Gokak farm.

The following four varieties of guavas are cultivated in this presidency :—

1. *Fruits* round, of the size and form of lemon, perfectly smooth exterior of pale straw colour ; *pulp* soft and white.

2. *Fruits* round like No. 1, more or less with smooth outer surface ; *pulp* pink or deep pink with strong strawberry perfume but not as soft as No. 1.

3. *Fruits* large, long with a bottle-neck at the stalk end ; surface green, irregularly warted ; faintly strikingly vertically 5 furrowed ; *skin* rather thick, outer colour green ; *pulp* white and hard.

4. Like No. 3 but *pulp* red and not so hard.

Diseases, pests, etc.

The aphis (Mawa) is the only pest which damages guava trees to a certain extent. It is well to spray either with tobacco emulsion or with crude oil emulsion.

The flying foxes also cause trouble at night by creeping along pendent fruiting branches and eating the fruits. Frightening them at night is the only remedy. The method of bending the branches and tying them horizontally is said to prevent the flying foxes from reaching the fruits.

Pollination. The guava flowers are normally constituted for cross-pollination which is easily effected by the honey bees which are seen swarming amongst the flowers. In spite of free cross-pollination, we do not find many varieties or types of fruits, nor do we get any variation among plants raised from seeds. This might be due to the fact that the locally cultivated variety is a pure line, fertilization within which produces no variation.

A white variegated variety is known as a curiosity. A case of bud sporting has also been noticed in which a normal tree produced a branch bearing variegated leaves. **Psidium cattleianum** and **Psidium guiniensis** are known to fruit fairly well. But they are cultivated only in private amateur gardens.

Area. In the year 1922-23 the total area under guavas was 4111 acres. The crop is well spread in the districts of the Deccan and Karnatak. It practically finds no place in the Konkan, and of the

Gujarat districts only Ahmedabad returns a fair area. Nasik, Poona and Ahmednagar grow between 600 to 700 acres each, Dharwar and East Khandesh over 400 acres. The fruit is very popular with the Indian section of the population. The Bombay Presidency does not export guavas ; on the other hand, it imports this fruit from Agra and Delhi.

17. LYTHRACEÆ

Trees or shrubs : *leaves* entire usually opposite, exstipulate : *flowers* regular, hermaphrodite ; *calyx tube* more or less adnate to the ovary ; *lobes* 3-6 ; *petals* usually as many as the calyx lobes and inserted near the top of the calyx tube ; *stamens* definite or indefinite, also inserted on the calyx tube ; *ovary* superior or rarely inferior ; *ovules* many : *fruit* coriaceous, dehiscent or not ; *seeds* many.

1. PUNICA, L.

A small tree or shrub with dark grey bark : *leaves* opposite, subopposite or clustered : *flowers* axillary, solitary or in clusters, large, orange red ; *calyx tube* funnel-shaped, coriaceous, adnate to the ovary below, enlarged above ; *lobes* 5 to 7, persistent or deciduous on the fruit ; *petals* 5 to 7, lanceolate, wrinkled, inserted between the calyx lobes ; *stamens* many : *ovary* inferior, with many cells in two rows ; *style* long bent ; *stigma* capitate ; *ovules* very many ; *placentas* axile in some cells, parietal in others : *berry* inferior, globose or elliptic ; *seeds* many, angular, *testa* coriaceous with a pulpy outer coat.

1. **Punica granatum,** L. Pomegranate. **Vern.** Anar (H) ; Dalimb (M) ; Dalimbu (K) ; Dadum (G) ; Anar Dakum (S). *Branches* round, often spinescent : *leaves* 1 to 2½ inches long, oblong or obovate : *calyx* in flower about 1 inch long : *fruit* 2 inches and upward in diameter, usually globose, with a thick leathery rind which breaks up irregularly.

It flowers during the hot weather and June and July. Fuits ripen at the end of the rains. Cultivated throughout the Presidency and said to be a native of Afghanistan, Baluchistan and Persia. It is also probably wild in many parts of the outer Western Himalayas in the Punjab and Sind. A double flowered variety which does not bear fruit is common as an ornamental shrub in gardens. A white flowered variety was noticed by the writer at Nasik.

The following varieties are cultivated in this Presidency :—

1. **Poona.** Surface of fruit crimson, dark red or greyish green, sometimes variously spotted, dark or scarlet or brownish, basal and apical portions paler, 5 to 7 angular ; *apex* truncate, base with stalk inserted in a distinct hollow, height 3½ inches, circumference 11 to 12 inches, weight nearly one pound or slightly more ; *pericarp* thick, usually smooth ; *seeds* attached by short fumicles, oblong or conical, 5 or 6 angular, deep scarlet or pink and red ; *testa* pulpy, more or less astringent and agreeable : *calyx* often a persistent tube, sometimes not conspicuous.

2. **Dholka.** This variety is more or less similar to the **Poona** variety with the exception that the colour of the pericarp is decidedly paler,

The seeds are however much softer and the juice more agreeable. Cultivated in Dholka, Gujarat.

3. **Muscat.** Upper part of surface of *fruit* shining white with a red glow, lower red, obscurely 8 angular, apex hollow, height 3 inches, circumference 10 inches, weight 1 lb. ; *pericarp* hard and tough ; *seeds* 5 angular ; *pulp* pale red ; *calyx* lobes deciduous ; base of *style* prominent.

4. **Cabul.** *Fruit* obscurely 8 angular, colour deep red mixed with pale yellow, the hollow at the base covered by a hard rim on the inner side, circumference 11 inches, weight 1.lb. ; *pericarp* thicker than in the Muscat variety ; *seeds* with a dark pulp and bitter taste : *calyx lobes* deciduous ; basal portion of *style* protruding.

The last two varieties are not cultivated ; but their fruits which are much liked, are imported into this Presidency. Unsuccessful attempts have been made to grow them in the Presidency.

Pollination. Cross-pollination is the rule.

Pests.

Sursa disease (*Virochloa isocrates*). The fruits of pomegranates are often bored by a caterpillar which can be found out by cutting a fruit just near a hole. Eggs of this insect are laid on the ovary in the very early stages of the flower. The caterpillar on hatching bores the fruits, feeds on the juice inside and ultimately causes the fruits to drop down. Bags made of cheap tissue paper or of croft paper tied enclosing the flowers prevent access of the moth of the caterpillar which comes there for laying eggs. Removal of weeds harbouring the moths is also recommended.

Scale insects. These white insects stick to the lower surface of the leaves and cause some damage. The remedy is to spray with rosin wash.

Area. The total area under pomegranates in the year 1922-23 was 1,451 acres. More than half of the area is claimed by the Poona district where most is grown in Haveli, Bhimthadi and Purandhar talukas The Dholka taluka of the Ahmedabad district claims 15 per cent. of the total area of the Presidency. The Ahmednagar district grows about 15 per cent., most of it being claimed by Pathardi, Rahuri, Ahmednagar and Sangamner talukas. Except in a few places like the Dholka taluka and a few villages in the Poona district, the fruit is not of a superior quality. Fruits of better quality are imported from Mascat, Harvai (Baluchistan) and Peshawar.

18. ONAGRACEÆ

Herbs : *calyx* tubular, of 2 to 6-valved lobes, united to the inferior ovary ; *petal* 2 to 6, inserted on the calyx ; *stamens* as many or twice as many as the petals, similarly inserted : *fruit* a capsule or berry.

TRAPA, L.

Floating herbs : *calyx* lobes persistent, becoming spiny on the fruit ; *petals* and *stamens* 4 : *fruit* bony, beaked 4-angled, one-seeded.

1. **Trapa bispinosa,** Roxb. WATERCHESTNUT. **Vern.** Singada (M); Singari (G); Shringata (S). *Stem* thick, submerged: *leaves* in thread-like segments; *floating leaves* whorled, broad, reniform or angular, covered with brown hairs beneath; *petioles* with large oval vescicles: *flowers* white; *disk* angular, yellow and hairy: *fruit* long stalked, with two straight barbed spurs.

Commonly cultivated in tanks in Ahmedabad, Prantij and other places in Gujarat. The fruit is edible. It is eaten boiled. Dried fruit is sold in the market. The Hindus use the starch prepared from the fruit on fast days. The boiled fruit is pleasant to eat.

19. CARICACEÆ

A shrub: *leaves* alternate, palmate, exstipulate: *flowers* dioecious, white, the *males* in drooping panicles, the *females* in subsessile fascicles; *calyx* campanulate; *corolla* of male salver shaped, tube slender elongate; *stamens* 10, inserted on corolla of male in two series; *pistillode* subulate; *corolla* of female large; *petals* 5, oblong, free, deciduous; *staminodes* none; *ovary* 1-celled, with 5 parietal placentas; *ovules* many: *fruit* a large melon-like berry, hollow; *pericarp* thick, fleshy, bearing a dense layer of seeds on its inner surface; *seeds* ovoid with an adnate arillus.

1. CARICA, L.

1. **Carica papaya,** L. PAPAYA. PAPAW. **Vern.** Popai (M); Papai, Paputa (G); Katha chibudo (S); Peragi, Piranji (K). A spongy wooded, small, palm-like tree: *stem* covered with scars of fallen leaves: *leaves* large, with long petioles: *flowers* creamy, fragrant: *fruit* varying in size and shape; *flesh* yellow, soft; *seeds* black, tasting of cress.

Cultivated in gardens throughout the Bombay Presidency, especially more so in Ahmedabad, Poona, Ahmednagar and Yeola. The plant bears fruit within a year of the sowing of the seeds. Fruits are available almost throughout the year though not much in July and August, but are specially abundant from November to April. The plants branch in favourable situations and also if topped. The branches bear fruit. A plant gives fair sized fruits for three years after planting. Later the fruits borne are small sized and worthless. The milky juice of the unripe fruits yields papain, and the ripe fruit is supposed to possess digestive properties.

The original home of the papaya is said to be the West Indies, the shores of the Gulf of Mexico, and perhaps Brazil.

There are two principal varieties of the papaya (**Carica papaya**): (*i*) with green or yellow green coloured petioles and white flowers, and (*ii*) with dark red coloured petioles and yellow flowers. This is known here as the Washington Papaya.

If one were to study the flowers and to classify them, the following types will be observed:—

1. Dioecious pistillate: with large female flowers only on the stems in the leaf axils. This is the most common female plant.

2. Dioecious staminate : with long narrow tubular flowers arranged on long branching peduncles growing from axils of leaves. This is the most common male plant.

3. Andromonoecious : male and hermaphrodite flowers on long peduncles.

4. Polygamous : male, female and bisexual flowers on same long peduncles.

5. Polygamous : with male, female and hermaphrodite flowers on the same plant, the latter being of two types : one with 10 stamens and the other with 5 stamens ; the flowers give long fruits.

6. Males : with male flowers on short peduncles directly in the axil of leaves.

7. Males on long peduncles with many hermaphrodites.

8. Hermaphrodites on long peduncles.

9. Separate males and clusters of male flowers with hermaphrodites. This gives long fruit.

10. Many hermaphrodite flowers with a few female flowers.

11. A few hermaphrodite flowers with many females.

It must be remembered that none of these types or varieties are fixed and it seems that the papaya is still in a plastic condition as to sex.

Pollination. The papaya is cross-pollinated in nature except in hermaphrodite plants where self-pollination seems to take place. The female flowers set fruits under bag and therefore parthenogenesis is suspected.

Diseases. There are very few insect and fungus diseases of importance attacking papaya. Sometimes, the fruits are attacked by anthracnose.

20. CUCURBITACEÆ

Herbs or shrubs, climbing by means of tendrils : *leaves* alternate, often cordate, usually palmately lobed : *flowers* monoecious or dioecious, yellow or white, racemed, solitary or occasionally panicled ; *calyx* tube adnate to the ovary ; *lobes* usually 5, imbricate ; *petals*, 5, inserted on the calyx limb, gamopetalous or polypetalous ; *stamens* inserted at the mouth or near the middle or at the base of the calyx tube, usually 3 (sometimes 5 or 2) ; *anthers* free or united into a tube, one usually 1-celled and the other 2-celled ; *cells* straight or flexuose or conduplicate ; *connective* sometimes crested or produced ; *ovary* inferior, usually 3-carpellary ; *style* 1 with 3 stigmas, more rarely styles 2-3-4 ; *placentas*, usually 3, vertical, in double lines ; *ovules* usually many, horizontal, rarely pendulous : *fruit* generally berried or fleshy, indehiscent or dehiscing by valves or by a stopple ; *seeds* usually many, horizontal, rarely compressed, horizontal or pendulous, exalbuminous.

A. *Corolla* divided nearly or quite to the base into 5 petals ;

Petals with fimbriate margins.

Seeds many : *calyx tube* less than 3 inches: fruit very long, slender curved. 1. **Trichosanthes.**

Petals entire.

(*a*) *Calyx* tube of male flowers long ; *anthers* included in the tube cohering in an oblong head : *fruit* globose or bottleshaped .. .. 2. **Lagenaria.**

(*b*) *Calyx* tube of the male flowers short ; *filaments* exserted ; *anthers* free.

Male flowers partly in racemes : *endocarp* fibrous, opening by stopple .. .. 3. **Luffa.**

Male and *female flowers* solitary : *fruit* large indehiscent, covered with a waxy bloom .. 4. **Benincasa.**

(*c*) *Calyx tube* of *male flowers* short ; *filaments* scarcely exserted ; *anthers* more or less coherent.

Male flowers, with usually a large bract, partly racemed : *fruit* ovoid, tubercular and ridged .. 5. **Momordica.**

Male flowers clustered or solitary ; *connective* produced beyond the anther cells .. .. 6. **Cucumis.**

Connective of anthers not produced : *tendrils* 2-3-fid .. .. 7. **Citrullus.**

B. *Corolla* campanulate, divided about half way down.

Flowers yellow : *tendrils* 2-3-cleft .. 8. **Cucurbita.**
Flowers white : *tendrils* simple .. 9. **Coccinia.**

Most of the cultivated species of **Cucurbitaceæ** have bitter varieties which are wild. Occasionally individual plants amongst the cultivated ones are found to bear bitter fruits also. The writer found in July 1925, a cucumber with a bitter skin only at the stalk end. Fruits of all **Cucurbitaceæ** should be tasted before use in cookery.

1. TRICHOSANTHES, L.

Climber : *leaves* cordate, usually 3-7-lobed or angled, hairy : *tendril* 2-5-fid : *flowers* white ; *male penduncles* in pairs, one 1-flowered, the other racemose ; *calyx* long, tubular, teeth 5 ; *petals* divided nearly to the base, long fimbricate ; *stamens* 3 ; *anthers* almost included, connate, long linear, one 1-celled, two 2-celled ; *cells* conduplicate ; *female flowers* solitary ; *calyx* and *corolla* as in the male ; *ovary* 1-celled ; *styles* filiform 3- or 6-fid at apex ; *placentas* 3 ; *ovules* very many, horizontal, half pendulous : *fruit* long narrowly cylindrical, smooth ; *seeds* many,

horizontal, packed in pulp, compressed, ellipsoid, sometimes angular on the margins.

1. **Trichosanthes anguina,** L. Snake Gourd. **Vern.** Chachinda (H) ; Padval (M) ; Padaval Kayi (K) ; Pandol (G) ; Kadotri (S). *Leaves* often deeply palmate, hairy on both surfaces : *fruit* varying from 1 to 3 feet in length and 3 inches in diameter, often contorted, green striped with white when young, when ripe of a bright orange colour.

Grown in garden as a vegetable during the rainy season.

2. **Trichosanthes dioica,** Roxb. **Vern.** Parwar (M). *Stems* twining, *tendrils* bifid : *leaves* cordate, oblong acute. 3 by 2 inches, harsh, sinuate, dentate, not lobed ; *petiole* scabrous, woolly : *male penduncles* paired, not racemed, woolly without ; *anthers* free : *fruit* 2-3 inches oblong, nearly spherical, orange red ; *seeds* half ellipsoid, compressed on the margin.

The leaves resemble those of Tondli (**Coccinia indica**), but are a little longer and rougher. The fruits are highly valued as wholesome and nutritious vegetable. Watts (16) says " the leaves and fresh juice, the fruit and the root are all used medicinally while the unripe fruit is eaten by the natives and the tender tops are cooked as pot herbs. The young and unripe fruit is valued by Europeans next to potatoes and brinjals and is perhaps the vegetable in greatest favour with them. " It is grown as a common vegetable in Northern India, Bengal and in Baroda. It has recently been introduced with great success in Palghar.

There are two varieties of the plant, one with oblong fruits like the tondli fruit and the other with globular fruits.

2. LAGENARIA, Ser.

Climber : *tendrils* 2-fid : *leaves* ovate or orbicular, cordate, dentate ; *petiole* long, with two glands near the apex : *flowers* large, white, hairy, solitary ; *males* with long, *females* with short penduncles ; *calyx tube* funnel-shaped, sub-campanulate, teeth 5, narrow ; *petals* 5, free, obovate ; *male flowers* with *stamens* 3 ; *anthers* connate included, one 1-celled, two 2-celled ; *cells* conduplicate ; *female flowers* with ovary oblong ; *style* short, with 3-bifid stigmatic lobes : *fruit* large, ultimately thick, membranous, or almost woody, indehiscent, polymorphous, usually broader upwards ; *seeds* very many, horizontal, compressed, smooth with a marginal groove.

1. **Lagenaria leucantha,** Rusby (*L. vulgaris,* Ser.). Bottle Gourd. **Vern.** Dudhya Bhopala (M) ; Halagumbala (K) ; Dudhi (G) ; Kaddu irao, hurrea kadava (S).

Usually grown as a rambling, procumbent plant throughout the year, especially in the Konkan. Ripe fruits are sometimes said to attain a weight of 20 lbs.

Fruits vary greatly in shape, but are usually bottled or Indian club-shaped. The dried shells of ripe fruits are often used as vessels for holding fluids and one sort Kadava dudhia or Bitter Bottle gourd, is used as floats by fishermen.

3. LUFFA, L.

Large or small climbers : *tendrils* 2-5-fid : *leaves* cordate, usually 5-angular or 5-lobed ; *petiole* without gland at the apex : *flowers* yellow ; *males* in axillary racemes ; *female* solitary, usually from the same axils as the males ; *calyx tube* top-shaped ; *lobes* 5, triangular or lanceolate ; *petals* 5, obovate ; *male flower* with stamens 5 or 3 ; *filaments* free or connate ; *anthers* exserted, free, one 1-celled, the other 2-celled ; *cells* sigmoid, often on the margin of the broad connective ; *female flowers* with *calyx tube* shortly produced above the ovary ; *ovary* oblong ; *style* cylindric ; *stigma* 3-lobed ; *ovules* very many, horizontal : *fruit* large or small, smooth or angular, ultimately fibrous, dry, 3-celled, usually dehiscing by a stopple at the top.

Male flowers with 5 stamens : *fruit* clavate, smooth, 10-angled .. .. .. 1. **L. aegyptiaca.**

Male flowers with 3 stamens : *fruit* clavate, 10-winged .. .. .. 2. **L. acutangula.**

1. **Luffa aegyptiaca,** Mill. **Vern.** Ghosali (M) ; Tiprikayi (K) ; Turia (G) ; Turi Liasada (S). *Tendrils* 3-fid : *leaves* about 4 inches in diameter, rough, punctate on both surfaces : *male flowers* towards the ends of long peduncles ; *petals* often with elevated hairy green veins ; *stamens* 5 : *female flowers* solitary : *fruit* elongate, clavate, smooth, obscurely 10-ribbed ; *seeds* usually black narrowly winged.

Grown in gardens during the rains and the young fruits are used as vegetables. The fibrous network of the ripe fruit is used as a flesh brush or sponge.

The shape of the fruits, as in all species of this genus under cultivation, is exceedingly variable, ranging from a club-shaped fruit a foot long to an ovoid one not larger than a hen's egg.

2. **Luffa acutangula,** Roxb. **Vern.** Dodka (M) ; Hirikai (K) ; Turia (G) ; Turi (S). Similar in most respects to the preceding and differing chiefly by having 3 stamens and by its smaller and acutely ribbed fruit.

It is also grown during the same season and for the same purposes.

The shape of the fruits also varies ranging from a narrowly elongate club-shaped body, about 18 inches long, with low ribs to an ovoid one about a foot long, with deep ribs.

4. BENINCASA, Savi.

A large softly hairy climber : *tendrils* 2 fid : *leaves* cordate reniform orbicular, more or less 5-lobed ; *petioles* without glands : *flowers* large, yellow, ebracteate all solitary ; *calyx tube* campanulate ; *lobes* 5, leaf-like and serrate ; *petals* 5, nearly separate, obovate ; *male flowers* with *stamens* 3, inserted near the mouth of the tube ; *anthers* exserted, 1-celled, and the others 2-celled ; *cells* sigmoid ; *female flowers* with *ovary* oblong, densely hairy ; *styles* 3, with flexuose stigmas ; *ovules* numerous, horizontal ; *placentas* 3 : *fruit* large, fleshy, oblong, pubescent, indehiscent ; *seeds* many, oblong, compressed, margined.

1. **Benincasa cerifera,** Savi. WHITE PUMPKIN OR WHITE GOURD MELON. **Vern.** Golkaddu (H); Kohala (M); Sandigumbala (K); Kohala (G); Golkaddu (S). *Fruit* up to $1\frac{1}{2}$ ft. long, broadly cylindrical, hairy, ultimately covered with waxy bloom.

This plant, said to be a native of Japan and Java, is cultivated occasionally in gardens during the rainy season. It averages 5 lbs. in weight, is eaten as a vegetable, and is used in pickles and also in the manufacture of sweetmeats.

5. MOMORDICA, L.

Weak climbers: *tendrils* simple: *leaves* cordate 5-7-lobed: *flowers* yellow, monœcious or dicœcious; *females* solitary, peduncled; *males* solitary or racemed, bracteate; *females* solitary; *calyx tube* short, campanulate; *lobes* ovate; *petals* 5, shortly connate below; *male flowers* with *stamens* 3; *filaments* short; *anthers* ultimately free, one 1-celled, the others 2-celled; *cells* conduplicate; *female flowers* with ovary oblong; *style* long; stigmas 3; *ovules* very many, horizontal; placentas 3: *fruit* oblong or ovoid, tubercular, softly spiny; *seeds* obovate or flattened, smooth, corrugated or sculptured.

Monocious: *bracts* small, about the middle of the male peduncle: *fruit* longitudinally ribbed with rows of triangular tubercles ..	1. **M. chanrantia.**
Dicœcious: *bracts* large, at the apex of the male peduncle: *fruits* densely covered with large, soft spines	2. **M. dioica.**

1. **Momordica charantia,** L. **Vern.** Karla (M); Hagalkai (K); Karela (G, H); Karelo (S). *Flowers* yellow, about 1 inch in diameter: *male peduncles* with a reniform or orbicular bract at or about the middle, *fruit* 1 to 5 inches long, orange yellow or green or white, bright orange when ripe, ovoid, tapering to both ends, surface ribbed with triangular tubercles dehiscent; *seeds* immersed in red pulp, compressed.

Cultivated in gardens in the rains. Its native country is not known for certain. The fruit is used as a vegetable but requires steeping in salt water before use. Bitterness is removed by scraping away ridges and tubercles, where it is concentrated.

2. **Momordica dioica,** Roxb. **Vern.** Kartoli (M); Kartikai (K); Kartola or Kamkola (G). A dicœcious, perennial climber with a tuberous root: *tendrils* simple: *leaves* broadly ovate cordate, more or less deeply 3-5-lobed, glabrous: *bract* hooded, enclosing the male flower; *petals* 1 inch long, yellow; *bract* of *female flower* small, near the base of the peduncle: *fruit* 1 to 3 inches long, shortly breaked, densely covered with short spines; *seeds* many, immersed in a red pulp, compressed, corrugated on the margins.

Cultivated as a vegetable in the Deccan during the rains.

6. CUCUMIS, L.

Hispid or scabrous climbing herbs: *tendrils* simple: *leaves* entire, angled or palmately lobed, dentate or serrate: *flowers* all shortly

peduncled, yellow, monœcious, solitary or clustered in the axils ; *calyx tube* top-shaped or campanulate ; *lobes* 5, small ; *corolla* campanulate ; *lobes* 5, oblong or ovate ; *male flowers* with *stamens* 3 ; *anthers* free, one 1-celled, the others 2-celled ; *cells* conduplacate, flexuose ; *connective* crested ; *female flowers* with *ovary* ovoid ; *placentas* 3 ; *ovules* very many, horizontal ; *style* short, with 3 obtuse stigmas : *fruit* fleshy, indehiscent, large or small, spherical or elongated, smooth or tubercled ; *seeds* many, oblong compressed, mostly smooth.

Annual. *Leaves* usually 5-angled, softly hairy : *fruits* large spherical, ovoid elongated or contorted, smooth or hairy	1.	**C. Melo.**
Annual. *Fruit* sparingly tubercled ..	2.	**C. Sativus.**

1. **Cucumis melo,** L. Melon. **Vern.** Kharbuza.

A creeping scabrous annual, cultivated on the sandy beds of rivers during the dry season. It is supposed to be a native of North West India and perhaps Tropical Africa.

Var. **agrestis**, Naud. **Vern.** Takmak, Shendad, Shinde, Puttikai. Gourd small, egg-shaped.

Is probably the wild variety of the melon. The plant is however also cultivated in the Deccan and the fruits are largely sold in the markets at the beginning of the cold season. They are green, ellipsoid, slightly hairy and about 1½ inch long.

Cucumis melo var. **utilissima** is also mentioned by Mr. Shevde (15) as being under cultivation in the Deccan with the vernacular name of Tarkakdi.

Roxburgh (14) has the following interesting note on this plant :— " This appears to me by far the most useful species of **Cucumis** that I know ; when little more than half grown, they are oblong and a little downy ; in this state they are pickled ; when ripe they are as large as an ostrich egg, smooth and yellow ; when cut they have much the flavour of the Melon and will keep good for several months, if carefully gathered without being bruised and hung up ; they are also at this stage eaten raw and much used in curries by the natives. The seeds like those of the other cucurbitaceous fruits contain much farinaceous matter blended with a large proportion of a mild oil ; the natives dry and grind them into a meal, which they employ as an article of diet ; they also express a mild oil from them which they use in food and to burn in their lamps. Experience as well as analogy prove these seeds to be highly nourished and well deserving of more extensive culture than is bestowed on them at present."

2. **Cucumis sativus,** L. Cucumber. **Vern.** Khira (M) ; Kakdi (M) Savatikai (K) ; Kakri (G). *Leaves* hispid on both surfaces and also softly hairy ; *lobes* triangular, acute or acuminate dentate : young *ovary* muricate : *fruit* usually elongate, cylindrical, yellow green glabrous, tuberculate.

Said to be originally a native of Northern India. Largely cultivated in gardens throughout the year.

7. CITRULLUS, Neck.

Scabrous, herbaceous climbers : *stems* thick, angular, branching ; *tendrils* 2-fid (or 3-4-fid) : *leaves* petioled, palmately 3-7-lobed, with usually narrow sinuately pinnatifid segments ; *lobes* sometimes small : *flowers* monœcious, solitary, rather large ; *calyx tube* campanulate ; *lobes* 5, narrowly lanceolate, equalling the tube ; *corolla* campanulate, yellow inside, green and hairy outside ; *lobes* ovate oblong obtuse, prominently 5-nerved ; *male flowers* with *stamens* 3, short ; *anthers* scarcely connate, one 1-celled, the other 2-celled ; *cells* conduplicate ; *connective* not produced ; *female flowers* with ovary ovoid ; *style* short ; *stigmas* 3, reniform ; *placentas* 3 ; *ovules* many, horizontal : *fruit* large, globose or ellipsoid ; *seeds* very many, oblong, compressed, smooth.

Tendrils bifid : *fruit* up to 10 inches in diameter, smooth .. .. .. 1. **C. vulgaris.**

Tendrils 3-4-fid : *leaves* less divided : *fruit* 3 to 4 inches in diameter, hispid when young .. 1a. **C. vulgaris** *var.* **fistulosus.**

1. **Citrullus vulgaris,** Schrad. WATERMELON. **Vern.** Tarbuja (H) ; Kalingda (M) ; Kallangade (K) ; Tarbuj (G) ; Karing, Karigo, Charho, Meho (S). Young shoots, villous, woolly at the tips : *leaves* 3 to 8 inches long, usually deeply divided ; *petiole* villous : *fruit* greenish or clouded ; *flesh* watery, red or yellowish.

Cultivated throughout the Presidency on river banks after the water falls. Fruits ripen during the hot weather. The plant is said to be indigenous in Tropical and South Africa.

Many varieties exist and Mr. Shevde (15) has distinguished the following :—

1. **Pandhra Tarbuja.** Sangamner and Dhulia. Whitish on outside, pulp deep rosy red, best to eat.

2. **Pandhra Tarbuja.** Sangamner and Dhulia. Whitish on outside, but pulp pale rose. Both these varieties keep for several weeks.

3. **Kala Tarbuja.** Sangamner and Dhulia. Dark green outside, pulp as in No. 1, not very good to eat, seeds black.

4. **Surai.** Sangamner. Fruit long, pulp red and seed reddish.

5. **Kalami.** Sangamner. Kabra or Chitra, Dhulia. Fruit round, pulp rosy, seeds black with white lines.

1-a. **Citrullus vulgaris,** Schrad, var. **fistulosus,** Stock. **Vern.** Dilpasand. *Tendrils* 3-4-fid : *leaves* less divided : *fruit* about 3 to 4 inches in diameter, globular, covered with short, stiff hairs, averaging 10 ozs. in weight ; when ripe, pure white, pale, yellow or red.

Mr. Woodrow (17) says that " this variety is cultivated generally in Gujarat and Sind but is not common in other districts. It is sown

in the hot season in *mulas* (structures resembling the betel houses of Central India, but having less shade) and is in use until the rainy season is well advanced. This fruit is eaten cooked as a vegetable."

8. CUCURBITA, L.

Large annual or perennial, climbing herbs, hispid or hairy: *tendrils* 2-4-fid: *leaves* petioled, cordate ovate, 5-angular or lobed: *flowers* monœcious, all solitary, yellow, very large; *calyx* campanulate; *lobes* linear or leafy; *corolla* campanulate; *lobes* short triangular; *male* flowers with *stamens* 3, inserted low in the calyx tube; *anthers* connate, one 1-celled, the others 2-celled; *cells* conduplicate; *female flowers* with *ovary* oblong; *style* short; *stigmas* 3, bifid; *ovules* very many, horizontal; *placentas* 3: *fruit* fleshy, indehiscent, often large; *seeds* ovoid or oblong, compressed, margined or not.

Leaves rigid; *petioles* below with pungent hairs: *calyx lobes* narrow, fleshy.

Peduncles round: *lobes of leaves* rounded; *sinuses* between lobes narrow.. .. 1. **C. maxima.**

Peduncles obtusely 5-gonal: *lobes of leaves* acute; *sinuses* between the lobes usually deep .. .. 2. **C. pepo.**

Leaves soft; *calyx tube* short; *segments* broad, spathulate, broad spathulate, leafy .. 3. **C. Moschata.**

1. **Cucurbita maxima,** Duchesne. The Great Pumpkin or Spanish Gourd. **Vern.** Bhopla (M); Kumbalakai (K); Sukkar Kohala (G); Kaddu (H). *Leaves* 4 to 6 inches in diameter, hispidulous, and softly hairy, with 5 shallow lobes or subentire: *calyx segments* lanceolate linear; *corolla* 3 to 4 inches in diameter: *fruiting peduncle* stout, corky, striated not grooved; *fruit* attaining the weight of 200 lbs.

Seeds are sown in the gardens in the rains and the very large fruits are fit for use as food from the end of the rains onwards. They will keep for a month or more after picking.

2. **Cucurbita Pepo,** L. The Pumpkin. *Leaves* 4 to 5 inches in diameter, softly hairy, hispidulous on the nerves beneath; *lobes* acute, hairs on the *petioles* beneath almost prickly: *corolla* 3 to 4 inches: *fruiting peduncle* woody, shortly grooved.

The treatment of the plant and its duration is as in the last species. It is said to be a native of America and a form of this species is the Vegetable Marrow.

3. **Cucurbita moschata,** Duchesne. Melon Pumpkin, Musk Melon. **Vern.** Kashiphal, Kala Bhopala (M). Hairs of the *petiole* equal, not pungent: *calyx segments* spathulate or foliaceous.

Cultivated. Cooke (3) says "The fruit is of various shapes, ovoid, clavate, or sub-globose and depressed at the apex and base and more or less ribbed, dark green when young, covered with a delicate glaucous bloom when ripe. (Duthie),"

The three species of **Cucurbita** are difficult to distinguish from one another.

Duthie quoted by Cooke (3) distinguishes them as follows :—" The hairiness of **C. moschata** is harsher than that of **C. maxima**, but much less so than that of **C. Pepo,** which is decidedly pungent. The leaves of **C. moschata** are usually marbled with whitish plotches ; not so in **C. maxima,** rarely in **C. Pepo.** The calyx segments of the female flower of **C. moschata** are leaf-like, those of the other two subsulate, while the glaucous bloom on the fruit of **C. moschata** is characteristic."

9. **COCCINIA** Wight & Arn. (*Cephalandra,* Schrad.)

Climbing herbs, scarcely hairy : *tendrils* simple : *leaves* petioled, 5-angular or 5-lobed, toothed : *flowers* dicœcious, moderately large, all solitary and white, ebracteate ; *male* with *calyx tube* campanulate, short ; *limb* 5-lobed ; *corolla* campanulate, 5-lobed about half way down ; *stamens* 3 ; *anthers* exsert, connate, one 1-celled, two 2-celled ; *cells* conduplicate ; *female* with *calyx* and *corolla* as in the male ; *ovary* oblong ; *style* long with 3-fid stigmas ; *ovules* many, horizontal ; *placentas* 3, vertical : *fruit* fleshy, indehiscent, cylindric, smooth ; *seeds* many, ovoid, compressed, margined.

1. **Coccinia cordifolia,** Cogn. (*C. indica,* Wight & Arn.). **Vern.** Tondli (M) ; Tondikai (K). *Leaves* 2-4 inches in diameter, 5-angular, 5-lobed, papillose, scabrid ; *petiole* one inch : *male peduncle* 1 inch, joined below the flower ; *calyx lobes* linear oblong ; *corolla* nearly 1 inch ; *lobes* long, triangular ; *female peduncle* about $\frac{3}{4}$ inch ; *ovary* smooth : *fruit* 1-2 by $\frac{1}{2}$-1 inch, bright scarlet.

Var. **Palmata.** *Leaves* deeply lobed ; *segments* sometimes narrow and simate.

It is doubtful if this is really a variety since the writer has seen extremely deep lobing of the leaves on one and the same plant when grown under good cultivation.

This plant is commonly cultivated for its fruits which are eaten both raw and cooked. There is a wild variety of it growing in hedge rows and those fruits are bitter.

21. UMBELLIFERÆ

Herbs : *leaves* alternate, exstipulate, finely divided ; base of *petiole* sheathing : *flowers* hermaphrodite or polygamous, in compound umbels, exterior of the umbels sometimes radiant ; *umbels* with bracts forming an *involucre* and *umbellules* with bracteoles forming involucels ; *calyx tube* adnate to the ovary ; *limb* absent or 5-toothed ; *petals* 5, epigynous, often unequal ; *stamens* 5, epigynous ; *ovary* inferior, 2-celled ; *disk* 2-lobed ; *style* 2 ; *stigmas* capitellate ; *ovules* one in each cell, pendulous : *fruit* of two indehiscent, dorsally or laterally compressed carpels, separated by a commissure ; *carpels* each attached to and often pendulous from a slender often forked axis, the *carpophore,* with primary ridges (1 dorsal, 2 marginal and 2 intermediate) and often 4 secondary

ones intercalated between these : *pericarp* often traversed by oil canals (vittae) ; *seed* 1 in each carpel, pendulous ; *albumen* cartilaginous.

A. *Fruit* laterally compressed ; secondary *ridges* inconspicuous or none : *umbels* terminal and leaf opposed ; *petals* white ; *bracts* and *bracteoles* present	1. **Carum.**
B. *Fruit* circular in transverse section ; *carpophore* distinct, 2-partite : *bracts* absent ; *petals* yellow	2. **Foeniculum.**
C. *Fruit* dorsally compressed ; lateral *ridges* winged : *petals* yellow ; *bracts* and *bracteoles* absent	3. **Peucedanum.**
D. Secondary *ridges* of *fruit* prominent ; *fruit* glabrous, globose : bracts absent ; *petals* white	4. **Coriandrum.**
E. *Fruit* narrowly oblong : *bracts* linear, rigid ; *petals* white	5. **Cuminum.**
F. *Fruit* bristly : *bracts* pinnate ; *petals* white	6. **Daucus.**

1. CARUM, L.

Annual herbs : *leaves* 2-3-pinnate or decompound : *umbels* compound ; *bracts* linear, simple, or sometimes divided ; *flowers* white, polygamous ; *sterile flowers* often with enlarged and irregular petals ; *calyx teeth* small or absent ; *petals* retuse or emarginate : *fruits* ovoid, laterally compressed ; *carpels* terete, sub-pentagonal. plane on the inner face ; *primary ridges* slender, conspicuous or obscure, lateral commissural ; furrows 1-vittate ; *carpophore* 2-fid or 2-partite ; *seed* terete, dorsally sub-compressed, plane or obscurely channelled on the inner face.

Ultimate *segments* of lower *leaves* oblong, linear, of upper linear : *fruit* hispid ; *ridges* distinct : *bracteoles* 4 to 8, lanceolate	1. **C. Roxburghianum.**
Ultimate *segments* of all the *leaves* linear : *fruit* muricate : *bracteoles* 3-5, linear	2. **C. copticum.**

1. **Carum Roxburghianum,** Benth. **Vern.** Ajawan (H, K) ; Owa (M) ; Ajamo (G). About 3 ft. high : *root* white, fusiform : *stems* glaucuous and slightly hairy : *leaves* ternately cut ; *lobes* of the lower oblong, linear, of the upper linear : *bracteoles* 4 to 8, subulate, margins white and ciliate ; *petals* ovate, with an inflexed apex : *fruit* 1/10 to 1/12 inch long, hispid.

Cultivated, particularly in Gujarat, for the sake of its carpels, which are aromatic and used as a condiment.

2. **Carum copticum,** Benth and Hook. Bishop's Weed. **Vern.** Ajawan (M, K) ; Ajamo (G). From 1 to 3 ft. high : *leaves* sparse, decompound, ultimate segments all linear ; *involucres* from 4 to 8 linear,

sometimes divided ; *petals* keeled, *tips* involute : *fruit* half an inch, ovoid, muricate ; *ridges* distinct.

Cultivated extensively in gardens for the sake of its fruits which are used as spice and also medicinally. In Europe thymol, used as an antiseptic, is prepared from them.

2. FOENICULUM, Mill.

A tall, glabrous, dark green annual : *leaves* decompound, ultimate segments linear : *bracts* absent ; *bracteoles* absent, or few, very small ; *calyx teeth* absent ; *petals* yellow, emarginate : *fruit* not compressed, ellipsoid ; *ridges* prominent, subequal ; *furrows* 1-vittate ; *carpophore* 2-partite.

1. **Foeniculum vulgare,** Mill. FENNEL. **Vern.** Sanuf (H) ; Badishep, Shepu (M) ; Badesepu, Sabbasige (K) ; Varialli (G). Plant 2 to 4 ft. high, uniformly pale green : ultimate *segments* of *leaves* very narrow : *umbels* compound, large.

Cultivated in gardens, especially in Gujarat and Khandesh. The leaves are used as a vegetable and the fruit is medicinal.

3. PEUCEDANUM, L.

A perennial, glabrous herb : *leaves* 2 to 3 pinnate ; ultimate *segments* linear : *bracts* and *bracteoles* absent ; *corolla* yellow, uniform ; *petals* obovate, emarginate : *fruit* dorsally much compressed, ellipsoid ; *carpels* winged on the margins ; *dorsal* intermediate ; *ridges* distinct, slender; *vittae* large, solitary in each furrow.

1. **Peucedanum graveolens,** Benth. DILL. **Vern.** Sowa (H); Balantshep (M) ; Surva (G). Plant 1 to 3 ft. high : *pedicels* $\frac{1}{2}$ inch long : *fruit* $\frac{1}{6}$ to $\frac{1}{12}$ inch, narrowly winged, plano-convex.

Cultivated for the sake of its fruits which are used as condiment and also medicinally.

4. CORIANDRUM, L.

An annual smooth herb : *leaves* decompound : *umbels* compound; *rays* few ; *bracts* absent or small and linear ; *bracteoles* few, filiform ; *calyx teeth* small, acute, often unequal ; *petals* obovate, emarginate, white or purple ; *outer flowers* often radiant : *fruit* sub-globose ; *ridges* not prominent ; *vittae* obscure, solitary, under the secondary ridges ; *seeds* convexoconcave almost three times as broad as thick.

1. **Coriandrum sativum,** L. CORIANDER. **Vern.** Dhania (H); Kotmir (the plant), Dhane (the fruit) (M) ; Kotambri bija, Haveeja (K) ; Dhana (G) ; Dhano (S). A small herb with the odour of bugs when bruised : upper *segments* of the lower *leaves* ovate or lanceolate, of the upper linear : *fruit* $\frac{1}{10}$ inch long.

Extensively cultivated for the leaves which are used for flavouring curries and for the seeds which are used as condiments and also medicinally.

5. CUMINUM, L.

A slender, annual, smooth herb : *leaves* twice or thrice partite ; ultimate *segments* filiform : *umbels* compound ; *rays* few ; *bracts* and *bracteoles* linear, rigid ; *calyx teeth* small, subulate, unequal ; *petals* white, oblong or obovate, emarginate, often unequal : *fruit* cylindric ; *tip* narrowed ; *primary ridges* filiform, distinct, secondary usually hispidulous ; *vittae* large, solitary, under each secondary ridge ; *carpophore* 2-partite or 2-fid.

1. **Cuminum cyminum,** L. Cummin. **Vern.** Jira ; Jirigi (M); Jiru (K) ; Zero (G, S).

Cultivated throughout the Bombay Presidency. The carpels are used medicinally.

6. DAUCUS, L.

Annual or biennial hispid herb : *leaves* 2-4-pinnate ; ultimate *segments* small or narrow ; *umbels* compound, large ; *rays* usually many ; *bracts* many, pinnate ; *bracteoles* many, entire or 3-fid ; *calyx teeth* small or absent ; *petals* obovate, emarginate, white, outer often radiant : *fruit* elliptic ; *ridges* all prominent, all or the secondary only bristly; *vittae* solitary, under the secondary ridges ; *carpophore* entire or 2-fid.,

1. **Daucus carota,** L. Carrot. **Vern.** Gajar (M) ; Gajjare (K) ; Gajar (G) ; Petaigagar (S). Herb 1 to 4 ft. high : *outer rays* connivent in fruit : *fruit* $\frac{1}{10}$ inch long ; bristles of secondary *ridges* long, white.

Cultivated throughout the Presidency for the sake of its long conical yellow or pink roots which are used as a vegetable. Coarser varieties are also grown for feeding horses.

Woodrow (17) says that the Deccani carrot is a root of good flavour, but small and very uncultivated—looking, averaging 5 inches in length and $2\frac{1}{2}$ inches in thickness at the top, suddenly reducing to the point and buried to the crown. The seed is comparatively large and the leaves not much divided.

The following vegetables are grown only in the gardens of the Europeans :—

Apium graveolens, L. Celery.

Petroselinum hortense, Hoffm. (*P. sativum,* Hoffm). Parsley.

Pastinaca sativa, L. Cultivated Parsnip.

22. COMPOSITÆ.

Herbs : *leaves* alternate, rarely opposite, simple, extipulate : *inflorescene* a capitulum closely surrounded by involucral bracts ; *floral bracts* reduced to pales, scales or bristles on the receptacle ; *flower heads* discoid or rayed, tubular or ligulate ; *calyx* superior, bearing papus ; *corolla* epigynous ; *stamens* 4 to 5, included within the corolla tube ; *filaments* free ; *anthers* coherent ; *cell* simple or tailed at the base ; *ovary* 1-celled ;

style slender, 2-fid, *arms* linear ; *ovules* solitary, basal : *fruit* a dry indehiscent achene ; *seeds* erect, exalbuminous.

Leaves opposite or upper alternate : *heads* rayed, yellow ; *ligules* 2-3-toothed ; *female* fertile ; *disk flowers* hermaphrodite tubular ; *outer bracts* subfoliaceous ; *pappus O* ..	1.	**Guizotia.**
Leaves alternate, spinescent : *heads* homogamons ; *flowers* yellow, all hermaphrodite, tubular ; *outer involuceral bracts* spinescent ..	2.	**Carthamus.**
Milky herb ; *leaves* radical and alternate, toothed ; *flowers* blue, all ligulate ; *involucral bracts* narrow, few seriate	3.	**Lactuca.**

1. GUIZOTIA, Cass.

Annual herb : *leaves* opposite or the upper alternate : *heads* heterogamous ; *ray florets* seriate, female ; *disk florets* campanulate, hermaphrodite. *outer bracts* subfoliaceous ; *inner bracts* passing into pales ; *receptacle* convex or conical ; *pales* flat, scarious ; *anther bases* truncate ; *style* of hermaphrodite flowers with arms ending in subulate, hairy tips : *achenes* glabrous, dorsally compressed, *tip* rounded ; *pappus* absent.

1. **Guizotia abyssinica,** Cass. Niger Seed. **Vern.** Ram Til (H) ; Karale. Khurasni (M) : Gurellu. Huchellu (K) ; Ram Tal (G). A stout erect herb, up to 3½ ft. high : *leaves* sessile, semiamplexicaul ovate lanceolate or subcordate serrate : *heads* numerous, conspicuous, each about an inch in diameter ; *involucral bracts* 5, broadly elliptic or ovate, green ; *ligules* few, broad : *achenes* black and shining, subquadrangular, with the angles rounded and tapering to the base.

The seed is sown at the beginning of the rains and the seeds ripen in November or December.

Recently Dodder has been found as a parasite on this crop.

Area.—In 1914-15 the total area under this crop was 201,798 acres, and of this nearly half is claimed by the Nasik District. Poona follows with about 15 per cent., Ratnagiri will come next, and Satara claims about 7 per cent. Other districts grow less than 5 per cent. Gujarat does not grow niger seed except a small area in the Panch Mahals.

The seed contains from 41 to 43 per cent. of oil and yields in the country oil press from 30 to 32 per cent. of oil which is used for household purposes and especially in cooking.

2. CARTHAMUS, L.

An annual thistle-like herb : *leaves* alternate, rigid, spinescent : *heads* homogamous ; *flowers* all hermaphrodite, fertile, yellow or orange ; *tubes* slender ; *limbs* 5-cleft, dilated at the base ; *involucre* ovoid or sub-globose ; *bracts* many seriate, *inner* dry, entire or with a short fimbriate appendage, *outer* with a foliaceous toothed or spinescent appendage ; *receptacle* flat, densely bristly ; *filaments* usually hairy in the middle ; *anther bases* sagittate ; *auricles* connate ; *tails* short, fimbriate ;

style arms short or long : *achenes* obovoid, angular ; *pericarp* white ; *pappus* absent.

1. **Carthamus tinctorius**, L. Safflower. **Vern.** Kusum (H) ; Kardai (M) ; Kusibe (K) ; Kabri (seed), Kasambi or Kusumbi (the crop or dye) (G) ; Khoinbo (S). A plant 2½ to 3 feet high. One variety grown for the oil-seed is spiny with yellow flowers, the other grown for the dye produced from the flowers is less thorny and has orange-coloured flowers. There is a variety with yellow flowers.

Area.—The total area of this crop in the Presidency in 1914-15 was 426,617 acres, occupying the largest acreage of all the oil seeds. Most of the area is found in the rabi portion of the Desh tract. Ahmednagar, Sholapur, Bijapur and Poona Districts claiming together about three-fourths of the total area. Next come Dharwar and Belgaum. The Konkan and Gujarat do not grow any safflower except a little in the Ahmedabad district.

The seed contains 32 per cent. oil and yields 25 per cent. in the country oil press which deal with large quantities all over the Bombay Presidency. Large quantities of safflower seed are also exported. The cake is used as cattle food and is also found to be a very useful concentrated manure of sugarcane on the Deccan canals. Well prepared safflower cake contains about 38 per cent. albuminoids and at least 6 per cent. nitrogen.

3. LACTUCA, L.

An annual glabrous milky herb : *leaves* at first radical : *cauline* developed later, all ascending, toothed lower sessible, upper also sessible, semiamplexicaul : *heads* small, in large corymbose panicles ; *outer involucral bracts* triangular, *inner* linear : *achenes* black, many ribbed ; *beak* capillary ; *pappus* copious ; *hairs* slender, white.

1. **Lactuca sativa**, L. Lettuce. **Vern.** Salad : Hakkarike. Saleet (K). A cabbage-like herb when young, becoming about 2 feet high ultimately : *stem* erect : *flowers* in large spreading corymbose panicles : *leaves* smooth, pinnatifid or entire : *achenes* black with cylindric white beaks, tipped by copious white pappus.

Cultivated in gardens as a salad plant throughout the year usually from imported seed. There are two distinct varieties, the **Cabbage** and **Cos.** The first has broad rounded spreading leaves, the second has suberect and narrower leaves. An acclimatized variety called the **Poona Brown Coss** by Mr. Woodrow (17) is thus described by that gentleman. " It is a large lettuce of the true **Cos** form and black-seeded. *Leaves* a rich dark brown outside, greenish white inside, tender crisped and of good flavour. "

Helianthus annus, L. Sun-flower. **Vern.** Surya Phul. A variety of it, **Grandiflorus plenissimus**, known also as Russian Sun flower, is recognised by its enormous flower heads, large leaves and seeds. It has been found experimentally to yield a large amount of fodder for which its cultivation is recommended.

Helianthus tuberosus, L. JERUSALEM ARTICHOKE. This delicious vegetable is occasionally cultivated by the Malis of Poona where it sometimes gets a market. The plants grow well in garden soil to four feet high and produce their sun-flower-like blossoms in abundance. The tubers are fit for use in November and December.

Cynara scolymus, L. GLOBE ARTICHOKE. It is also cultivated in private kitchen gardens of the rich and Europeans. The plants which are rosette-like with large whitish prickly leaves come into bearing in February. The edible part is the involucre of flowers.

Cichorium Intybus, L. CHICORY. It is occasionally grown in the Deccan. Sometime back it was grown successfully at Nadiad and exported for mixing with coffee.

Artemisia pallens. Vern. Davna. It is cultivated round about Poona, Alandi, Jejuri for its fragrant leaves which are used in worship.

The following vegetables are grown only in the gardens of Europeans:—

Cynara cardunculus, L. CARDOON.

Tragopogon porrifolius, L. SALSIFY.

Cichorium enduria, L. ENDIVE.

23. SAPOTACEÆ

A densely branched evergreen tree, young parts rusty tomentose : *leaves* leathery, entire, alternate, exstipulate : *flowers* hermaphrodite, axillary, medium-sized; *pedicles* usually solitary, ebracteate ; *calyx* gamosepalous, of 6 sepals in two series, the 3 outer subvalvate, the 3 inner imbricate ; *corolla* gamopetalous, almost ureolate ; *lobes* 6, imbricate ; *stamens* 6, adnate to the base of corolla and opposite its lobes ; *staminodes* 6, petaloid ; *ovary* 10-12-celled ; *style* cylindric ; *stigma* small : *fruit* a milky, fleshy berry, with a brown rind, sub-globose or ellipsoid ; *seeds* few, oblong, albuminous.

1. ACHRAS, L.

As above.

1. **Achras Sapota**, L. SAPOTA. **Vern.** Chikku. A small tree of very slow growth : *leaves* clustered at the ends of the branches, shining, smooth : *flowers* $\frac{1}{2}$ inch in diameter, in clusters from the uppermost axils ; *pedicels* $\frac{3}{4}$ inch long, rusty tomentose as are also the broad *sepals* ; *petals* a little longer than sepals, yellowish white : *fruit* rusty on the surface, varying much in size and shape, in the best varieties as large as a hen's egg. Two shapes of fruits are noticed on the same plant : round and small and oval and long. Self-pollination takes place.

Said to be a native of America. Cultivated in orchards throughout the Presidency but thriving best near the sea. The fruits ripen throughout the dry season and are largely sold in markets.

24. CONVOLVULACEÆ

A prostrate shrub, spreading and rooting : *leaves* alternate, exstipulate : *flowers* large, showy ; *sepals* 5, imbricate ; *corolla* funnel-shaped ; *limb*

plaited ; *stamens* 5, included, epipetalous; *ovary* usually 2-celled ; *ovules* usually 4 ; *style* slender : *stigma* capitate : *capsule* 4-6-valved ; *reeds* usually 4.

1. IPOMŒA, L.

As above.

1. **Ipomœa Batatas**, Lam. SWEET-POTATO. **Vern.** Sakharkand (H) ; Ratalu (M) ; Genasu (K) ; Sakaria (G) ; Gajar (S). A trailing plant : *tubers* long, purple or white ; *stems* smooth or slightly hairy : *leaves* ovate cordate, acute, angular or deeply lobed : *peduncles* usually solitary ; *sepals* elliptic, acuminate, glabrous ; *corolla* about 2 inches long, purple : *capsule* 4-celled, rarely produced ; *seeds* smooth.

A native of America. Cultivated as a garden crop in this Presidency principally in the cold season and occasionally in the rains. Cultivated in hot weather on an area of 12,000 acres.

Two varieties are known. The first and most common with cordate, angular leaves and red or purple fusiform tubers, the second with deeply palmate leaves, lighter coloured flowers and white tubers. A third variety known as **Cluster Sweet Potato** has recently been introduced by the Agricultural Department from Ceylon, which has a natural tendency to form all the tubers in clusters near the surface.

The plant never produces seed and propagation is effected by stem cuttings which grow freely and readily, soon covering the surface of the plots.

25. SOLANACEÆ

Herbs or shrubs : *leaves* alternate, entire lobed or pinnate, exstipulate : *flowers* regular, hermaphrodite, in terminal, axillary or extra axillary cymes or on solitary or clustered pedicels ; *bracts* and *braceoles* absent ; *calyx* gamosepalous, usually 5-toothed or lobed; *corolla* gamopetalous, funnel-shaped or rotate ; *lobes* usually 5 ; *stamens* 5 on the corolla tube ; *ovary* usually 2-celled ; *ovules* many, on prominent, axile peltate placentas *style* linear; *stigma* capitate: *fruit* a berry or a circumscissile or valved, capsule usually 2-celled, many-seeded ; *seeds* compressed discoid or sub-reniform.

A. *Corolla* rotate : *fruit* a berry with many compressed seeds :
Anthers connivent.
Anthers dehiscing introsely by longitudinal slits, the tips empty : *leaves* pinnatisec .. 1. **Lycopersicon.**
Anthers dehiscing by apical pores or by short apical slits : *leaves* entire, lobed or pinnatifid. 2. **Solanum.**
Anthers not connivent, dehiscing longitudinally.
Flowers solitary or in pairs; *calyx* in fruit small : *fruit* a dry berry, usually tapering rarely, globose .. .. .. 3. **Capsicum.**

Flowers solitary ; *calyx* accrescent, balloon-shaped, completely inclosing the globose berry .. .. .. 4. **Physalis.**

B. *Corolla* funnel-shaped ; *flowers* in panicles : *fruit* capsular ; *seed* round .. .. 5. **Nicotiana.**

1. LYCOPERSICON, Mill.

A tall, rambling pubescent herb, with a characteristic smell when brusied : *leaves* pinnate ; *pinnae* irregular, usually in alternating large and small pairs ; *margins* lyrate or toothed : *flowers* in few flowered lax cymes ; *calyx* 5 or 6-partite ; *sepals* narrow, not accrescent ; *corolla* rotate, yellow ; *limb* 5 or 6-lobed ; *stamens* 5, on the short corolla tube ; *anthers* connivent : *style* cylindric ; *stigma* small, capitate : *fruit* a fleshy berry.

1. **Lycopersicon esculentum,** Mill. Tomato. **Vern.** Gur began (H) ; Wel Wangi (M) ; Chapparbadnikai (K) ; Vilaiti Vagan (G). Whole plant with the exception of the corolla and fruit uniformly hairy; many of the hairs glandular : *leaves* thickly membranous : *fruits* red or yellow, varying much in size, globose or pyriform and with a rounded or more less deeply lobed surface.

Cultivated everywhere in gardens throughout the year for the fruit which is used as a salad or vegetable. The finest varieties are grown from seeds imported from Europe. The varieties such as **Baltimore, Bonny Best, Peach Blow**. and **Magnum Bonum** are introduced in cultivation.

2. SOLANUM, L.

Herbs, unarmed or prickly : *leaves* alternate, entire or lobed, pinnatifid : *flowers* in lateral or terminal, often extra-axillary cymes ; *calyx* 5-partite, accrescent or not in fruit ; *lobes* narrow ; *corolla* rotate, 5-lobed ; *stamens* 5, on the short corolla tube ; *filaments* short ; *anthers* conniving in a cone, opening by terminal pores or short slits ; *ovary* 2-celled ; *style* columnar ; *stigma* small : *fruit* a small or large, firm berry ; *seeds* very many, discoid.

Unarmed, bearing subterranean tubers : *leaves* pinnatifid : *flowers* blue or white .. 1. **S. tuberosum.**

Armed or unarmed, not bearing tubers : *leaves* sinuately lobed : *calyx* enlarging under the fruit.

Stem, leaves and *calyx* unarmed .. .. 2. **S. Melongena.**

1. **Solanum tuberosum,** L. Potato. **Vern.** Alu (H) ; Batata (M. K) ; Batata, Gangadi (G). *Roots* creeping, bearing tubers, of which the *buds* are known as eyes : *stems* winged : *leaves* interruptedly pinnate ; *leaflets* cordate, ovate and elliptic, pubescent, oblique at the base : *flowers* and *fruits* rarely produced, in corymbs.

Potatoes are grown sparingly in garden lands in all parts of the Presidency. The chief cultivation is in the Poona District (mostly in

the Khed Taluka) which claims 75 per cent. of the total area. Fairly large areas are grown in Ahmednagar, Satara, Dharwar, Belgaum, Surat, Kaira and Ahmedabad.

The crop is grown both in the kharif and rabi seasons in the Khed tract and near Mahableshwar (Satara District). At Belgaum it is purely a rabi crop, while at Dharwar it is a kharif one. In Ahmedabad potatoes are grown in the bed of the Sabarmati river in the rabi season.

Pests and Diseases.

Tambera or mite disease. Soon after the potato crop becomes a month or so old, the attacked field presents a reddish colour due to bronze coloured spots on leaves caused by an extremely minute insect called a mite. The young leaves acquire a bunched appearance, their edges becoming wrinkled. Gradually, commencing from the top of every shoot, the whole of the foliage withers and the plants die later on. The remedy consists in spraying the field in the early stages of the attack with lime-sulphur solution. It may be more easily combated by dusting the plants with lime-sulphur in the proportion of 80 to 20.

The Stem borer. In the early stages of the growth of the potato plant, its tops are seen falling over and wither due to a hole made in the tender stem by a caterpillar. The remedy is to cut the shoots and destroy.

The Potato Moth. Potatoes in the store or the ones which happen to be kept exposed are often attacked by a moth which lays eggs in the cavities of eyes. The caterpillars hatching out of the eggs bore into the potato and feed inside. As a result the potato becomes unserviceable both for eating and for seed. The remedies are to prevent exposure of the tubers in the field and storage and to store them in a moth-proof house or moth-proof gunny bags.

Bacterial Ring Disease. It is one of the commonest tuber diseases, which makes the tuber unserviceable for table and seed purposes. It is highly contagious. If the affected tubers are cut through, some of them will almost certainly show a brown ring a short distance in from the surface. This ring is usually found near the stem end. If a diseased tuber is cut and squeezed, a series of small creamy white shiny drops are to be seen exuding along the course of the brown ring.

The remedies are :—

(1) To plant disease-free potatoes either from abroad or from a stock from which ring disease has rigidly been eliminated for generations.

(2) While cutting the potatoes for planting out, any tuber that may show even the slightest symptoms of the disease should be rejected and destroyed and the knife employed in cutting such tubers should be sterilized by dipping it into boiling water before it is used for cutting the next tuber.

(3) The field, if infected with ring disease should be exposed to the sun and should not be used for resowing potatoes at least for six months.

(4) The vicinity of infected fields especially if they are on higher level, should be avoided as the disease is known to spread through drainage and irrigation water which may run from field to field and contaminate healthy crops.

(5) If during the growth of the crop, plants are seen wilting they should be carefully uprooted along with tubers and burnt.

2. **Solanum Melongena**, L. Brinjal or Egg plant. **Vern.** Begun (H); Vangi (M); Badnikai (K); Vengan (G); Vangan (S). A small shrub, seldom more than 3 feet high in cultivation: *leaves* large, sinvate or lobed, stellately wooly, beneath prickly (var. **esculenta** in which all parts of the plant, including the calyx are so) or unarmed typed: *peduncles* usually extra axillary, often paired, one bearing a solitary perfect flower, the other a short raceme of male flowers; *calyx lobes* lanceolate, becoming thickened and enlarged under the fruit; *corolla* up to $1\frac{1}{2}$ inch in diameter, blue: *berry* globose, ellipsoid or green, white, purple or black, varying from 1 to 9 inches in diameter.

The majority of the brinjals cultivated in the Bombay Presidency belong to the var. **esculenta,** which has all its parts prickly. Plants raised from European seeds are often destitute of prickles. Wild plants, which are found wherever brinjals are grown, are intensely prickly. The absence of defensive armour in the superior varieties may be the result of long continued cultivation. The commonest variety is purple and club-shaped, sometimes attaining the length of 1 foot, another variety of the same colour has a large, almost globular fruit about 8 inches in diameter. Two smaller ovoid sorts are purple or rarely white.

The plant is grown everywhere in gardens throughout the year. It is probable that it is a native of India or of the adjacent parts of Asia.

The mite disease also affects this crop. For remedies see under Potato.

3. CAPSICUM, L.

Annual or perennial, smooth herbs: *leaves* shining, entire or repand: *flowers* axillary, solitary or 2 to 3 together; *calyx* minutely 5-toothed, becoming thick and enlarged at the base of the fruit; *corolla* rotate; *lobes* ovate acute; *stamens* 5, attached near the base of the corolla; *anthers* dehiscing longitudinally; *ovary* 2-rarely 3-celled; *style* linear; *stigma* capitate: *fruit* a globose or elongated or irregularly shaped rather dry berry; *seeds* discoid, many.

Herbaceous: *leaves* smooth: *pedicels* usually solitary; *corolla* white (or very rarely purple)	1. **C. annuum.**
Shrubby: *leaves* more or less pubescent: *pedicels* usually 2 or more together; *corolla* white or greenish white	2. **C. frutescens.**

*1. **Capsicum annum**, L.

Dr. Cooke (3) divides this species into 5 varieties, with the following characters and remarks :—

Var. **acuminata**,, Fingerh. **Vern.** Mirchi ; Menashinakai (K) ; Marcha (M). Plant $1\frac{1}{2}$ to $2\frac{1}{2}$ feet high : *foliage* dense ; *leaves* solitary, sometimes semifascicled, ovate acuminate : *pedicels* slender, enlarging towards the apex ; *calyx* embracing the case of the fruit ; *corolla* dull white : *fruit* tapering, much longer than broad, usually more or less curved, red, yellow or orange ; *flesh* thin, pungent. The common chilli, largely cultivated.

Var. **abbreviata**, Fingerh. Plant 1 to 2 feet high : *branches* numerous, more or less angled : *leaves* broadly ovate : *pedicels* 1 to $1\frac{1}{2}$ inch long, usually solitary ; *corolla* dull white : *berry* seated on the calyx, not enclosed by it at the base ; *fruit* not or but little longer than broad, circular in cross section, usually sub-conical, ovoid or ellipsoid, more or less rugose, red or yellow when ripe, often variously blotched with brown before ripening ; *flesh* thin, pungent.

Cultivated sparingly, chiefly in the gardens of Europeans.

Var. **grossum**, Bailey. Spanish or Monstrous pepper. **Vern.** Kafri Mirchi, Bhopla Mirchi ; Donna Menashinkai (M). Plant herbaceous, $1\frac{1}{2}$ to 2 feet high : *branches* green, often warty, enlarged at the nodes which are often blotched with purple : *leaves* thick, the lower ones very large, on stout petioles 2 to 3 inches long : *pedicels* stout, $\frac{3}{4}$ to 1 inch long ; *calyx* not embracing the base of the fruit : *corolla* large, spreading, dull white : *fruit* large, angular in cross section, prismatic, quadrate or oblate more or less sulcate, usually with a basal depression : *flesh* thick, scarcely at all pungent.

These are grown sparingly, chiefly in the gardens of Europeans.

Var. **cerasiformis**, Bailey. Cherry pepper. Shrubby, 1-2 feet high : *branches* numerous, 4-angled, green or purple, usually purple, and much enlarged at the nodes : *leaves* ovate or oblong acuminate : *pedicels* $\frac{3}{8}$ to $\frac{1}{2}$ inch long, usually solitary ; *calyx* not embracing the base of the fruit ; *corolla* large, dull white : *fruit* spherical, sub-cordate, half to one inch in diameter, often, when unripe, blotched with purple on the side next the sun ; *flesh* firm, thick, extremely pungent.

Cultivated occasionally in the gardens of Europeans.

Var. **longum**, Bailey. Purple Chilli. *Branches* few, large, erect, green, often streaked with purple and with purplish nodes : *leaves* ovate acuminate with long petioles : *pedicels* axillary, $\frac{7}{8}$ to $1\frac{1}{8}$ inch long, curved or straight ; *calyx* hardly embracing the base of the fruit ; *corolla* purple or white, blotched with purple : *fruit* tapering, much longer than broad, nearly black at first, afterwards becoming orange-red ; *flesh* rather thick, usually mild in flavour.

Occasionally cultivated in the gardens.

The following are the two forms of chillies obtainable in the Poona market :—

Gowrani. *Fruit* sickle-shaped, *length* 100-117 mm., *breadth* maximum 14 mm., bright red, very hot ; *skin* thin ; *tip* distinctly bent

* *Capsicum annuum*, L. is synonymous with *Capsicum frutescens* L. The classification as originally given by Gammie is retained for the sake of convenience.

or even coiled : *calyx cup* smaller and *pedicel* thinner. This is probably Var. *longum*, Bailey.

Cultivated in Poona and round about.

Khandeshi. *Fruit* of *length* 100 to 130 mm ; *breadth* 14 to 20 mm ; dark orange red colour or pale orange red ; *calyx* bigger ; *tip* of *fruit* curved ; *calyx* broader and *pedical* thicker.

Cultivated in Khandesh.

This variety is probably Var. **acuminata,** Fingerh.

2. **Capsicum frutescens**, L. **Vern.** Lavungi Mirchi. Shrubby perennial plant, 2 to 6 feet high : *branches* angular : *leaves* broadly ovate acuminate, usually wrinkled, more or less pubescent : *pedicels* slender, usually 2 or more together 1-2 inches long ; *calyx* embracing the base of the fruit, usually cup-shaped ; *corolla* white or greenish white often with ochreous markings in the throat : *fruit* red, ovoid, obtuse or oblong acuminate.

The Bird's eye chilli of Europeans, cultivated but not extensively, often found as an escape.

Var. **Baccata**, Irish. Brazil Pepper or Pimenta. A much branched shrub : *leaves* ovate acuminate, narrowing abruptly into the petiole : *pedicles* usually 2 together, slender, 1 to $1\frac{1}{4}$ inch long, extra axillary, erect ; *calyx* short, not embracing the base of the fruit ; *corolla* small, greenish white : *fruit* globose or nearly so, about $\frac{1}{4}$ inch in diameter, changing from green to blackish spotted, finally ripening to red or yellow.

Occasionally cultivated.

Mollison (12) makes the following remarks on chillies generally :—

Vern. Marcha (G) ; Mirchi (M) ; Menashinaki (K).

The home of the common Indian variety is believed to be in Tropical America. Chillies were introduced into India in comparatively recent times, probably by the Portuguese.

The **Deshi** variety of the Deccan has a small, red pungent fruit, gradually tapering from a blunt base to a sharp point. The **Deshi** variety of Northern Gujarat is large, thick, irregulur in shape, inflated, sometimes curved, not very pungent and red in colour.

A variety with small, red, pungent fruit, similar to **Deshi** variety of the Deccan, is also cultivated in Northern Gujarat. The **Lavangia** variety of Surat has small, orange coloured, very pungent fruit. It takes its name from the Gujarati word Lavang (a clove).

This variety probably belongs to **Capsicum minimum.** The **Bor mirchi** gets its name from its resemblence to the fruit of the Bor tree **(Zizyphus jujuba.)**

Cultivation is by far the most important in Dharwar. Belgaum comes next and then Khandesh, Satara, Poona, Sholapur, Nasik and Ahmednagar. In Gujarat the crop is not of much importance.

The crop is invariably planted in the rains ; but if helped by irrigation, the growth extends into the rabi season.

4. PHYSALIS, L.

Perennial herb : *leaves* villous, alternate, entire or sinuate : *flowers* yellow, solitary, axillary pedicelled ; *calyx* in flower campanulate, in fruit greatly accrescent and ventricose ; *teeth* small connivent ; *corolla* campanulate, 5-lobed ; *stamens* 5, adnate near the base of the corolla ; dehiscence of *anthers* longitudinal ; *ovary* 2-celled : *style* linear : *stigma* obscurely 2-lobed : *fruit* a globose berry, enveloped in the bladder-like calyx ; *seeds* many, smooth or rugose, compressed.

1. **Physalis peruviana**, L. Cape-Gooseberry. **Vern.** Tipari (H). A stout spreading bushy herb, usually grown as an annual : *leaves* ovate ; *margins* entire or serrate ; *bases* truncate or subcordate, membranous ; *hairs* villous, slightly harsh : *corolla* about $\frac{1}{2}$ inch in diameter, yellow, with 5 purple spots near base ; *calyx* in fruit from 1 inch to $1\frac{1}{2}$ inch long, ovoid, conical, *texture* scarious : *berry* yellow, about $\frac{1}{2}$ inch in diameter.

A plant cultivated in gardens throughout the Presidency. The seeds are sown at the beginning of the rains and the fruits ripen in succession throughout the dry season. The plant is perennial in its nature, but it is not fruitful after the first year, it is only grown as an annual. It is said to be a native of Tropical America.

It makes an admirable jam.

5. NICOTIANA, L.

An erect, viscidly pubescent herb : *leaves* alternate, entire or sinuate : *flowers* in terminal panicles ; *calyx* ovoid or tubular ; *lobes* narrow, lanceolate ; *corolla* linear, funnel-shaped ; *lobes* 5 ; *stamens* 5, adnate to the lower part of the corolla tube ; *filaments* filiform ; *ovary* 2-celled ; *ovules* many ; *style* filiform ; *stigma* shortly 2-fid : *fruit* a 2-celled capsule, 2-valved to the middle and valves again splitting ; *seeds* very many.

1. **Nicotiana Tabacum**, L. Tobacco. **Vern.** Tamaku (H) ; Tambakhu (M) ; Tamakhu (G) ; Tamaku (S) ; Hogesoppu, Tambaka (K). A stout herb, tall or short, viscidly pubescent : *leaves* oblong or elliptic, sessile or shortly stalked ; *base* wedge-shaped : *flowers* in open corymbose panicles with short branches ; *corolla* pink and white, up to $1\frac{3}{4}$ inch long, lower two-thirds of the tube linear, remainder funnel-shaped ; *lobes* spreading : *capsule* $\frac{3}{4}$ inch long, conical.

Originally a native of America and now in general cultivation in India as a rabi crop. Luxuriant examples sometimes attain a height of 5 to 6 feet. The leaves become shorter upwards and in well cultivated examples the lower leaves are very large. In form they differ greatly according to the variety ranging from narrowly linear lanceolate tapering to both ends to broadly oblong obtuse and acute, the surface is plain or bullate.

Mollison (12) says that Belgaum and Kaira are the two chief centres of cultivation. Elsewhere the crop is only important in Satara, Khandesh, Ahmednagar, Ahmedabad and Broach.

The following varieties are distinguished :—

1. **Sumatra.** *Plant* tall, *internodes* being fairly far apart. *Leaf* has characteristic open habit of growth, with upper surface slightly palmated and shining. It is narrow for a considerable distance near base, then widens gradually, and may best be described as spindle-shaped. *Midrib* prominent, but not very coarse. *Veins* fine, straight, regular, not much branched. *Texture* fairly thin, fine, soft, elastic.

2. **Yaval No.** 1. (From Khandesh District). *Plant* has very low habit of growth, the *internodes* being very close together. *Leaf* slightly granulated, very narrow near base, long and narrower throughout than any other variety, widest one-third length from base, very sharp pointed. *Midrib* prominent and coarse, particularly near base, *veins* fairly prominent, rather irregular, branched to a considerable extent. *Texture* thick, coarse, soft.

3. **Yaval No.** 2. *Plant* with a fairly low set of habit of growth. *Internodes* short. *Leaf* fairly roughly granulated, large, broad, widest near base, ovate, point blunt. *Midrib* prominent and coarse. *Veins* and *reticulations* prominent and coarse. *Texture* soft, fairly thick.

4. **Peelia** from Nadiad (Kaira District). *Plant* fairly tall. *Leaf* granulated, large, widest about one-third length from base, narrow for a very short distance from base, then widens abruptly and tapers gradually to sharp point. *Midrib*, *veins* and *reticulations* prominent and coarse. *Texture* soft, thick.

5. **Shamru** from Nadiad (Kaira District). *Plants* with very low set habit of growth. *Internodes* very close. *Leaf* very granulated or crumpled, broad, greatest width one-fourth length from base, gradually tapering to a moderately blunt point. *Midrib*, *veins* and *reticulations* all prominent and coarse. *Texture* thick, coarse, soft.

6. **Gandiu** (Nadiad). *Leaves* broad ; *flavour* low strength. A very freely and vigorously growing variety cultivated under irrigation ; a heavy yielder.

7. **Keliu** (Nadiad). *Leaf* oblong, banana-like ; *flavour* good and strong, useful for Hukka smoking and snuff. This is a heavy yielder grown under irrigation.

8. **Movadia** (Nadiad). *Leaf* broadly oval like the Mohava leaf of poor strength or flavour. This is poor yielder but grown without irrigation.

9. **Shengiriya** (Nadiad). *Leaf* long, narrow, shaped like a legume and poor in strength. It is a poor yielder and grown without irrigation.

10. **Kalia** (Baroda). *Plant* tall or moderately tall. *Leaves* somewhat granulated. *Leaf* narrow for a short distance near base, then widens, broadest one-third length from base, moderately wide, long,

sharp pointed. *Midrib* and *veins* fairly coarse. *Veins* and *reticulations* numerous. *Texture* fairly thick and soft.

11. **Kalia** (Baroda). *Plant* fairly tall. *Leaf* crumpled or very much granulated, long, broad, narrow for a short distance near base then widens abruptly, widest, 2/5th length from base, thence tapers gradually to a sharp point. *Midrib*, *veins* and *reticulations* long, prominent and coarse. *Texture* thick, soft, coarse.

12. **Kari beglani** from Chikodi (Belgaum District). *Plant* tall. *Leaf* slightly granulated, large and moderately wide; one-third length from base, very narrow for 2 or 3 inches near base, somewhat spindle-shaped, sharp pointed. *Midrib* fairly prominent, moderately coarse. *Veins* not coarse and much reticulated. *Texture* fairly thick, soft.

13. **Bhopali** from Chikodi (Belgaum District). *Plant* tall. *Leaf* slightly granulated, folds double from *mid-rib* characteristically narrow for considerable distance from base, large, long, spindle-shaped, sharp pointed, resembling Sumatra somewhat in shape. *Midrib* prominent and coarse. *Veins* fairly prominent, but not numerous or much reticulated. *Texture* thicker and coarser than **Sumatra.**

14. **Shendi-surte** from Chikodi (Belgaum District). *Plant* medium height. *Leaves* very slightly granulated, narrow near base, broadest one-third length from base, long, ovate sharp pointed. *Midrib* fairly prominent and fairly coarse. *Veins* fairly prominent. *Reticulations* fine. *Texture* fairly soft, moderately thick.

Diseases and Pests.

Orobanche ægyptiaca, Pers. is a small plant parasitic on the roots of most of the crops belonging to the **Solanaceæ** such as tobacco, brinjal. It is a scapigerous scaly herb about 6 to 12 inches high, much branched, springing up from near the roots of the hosts. The pale brown stems are single with small branches all curved with acute scaly leaves. These plants cause great damage to the crops by sucking sap from their roots. Seeds are extremely small and drop down abundantly in the field long before tobacco is harvested giving rise to the next year's growth of parasites. Digging out the plants before seeding is the remedy.

26. PEDALIACEÆ

A tall herb: *leaves* opposite, upper alternate, very variable, entire, toothed, lobed or divided: *flowers* irregular, solitary or in fascicles of two or three, short stalked; *calyx* small, 5-partite; *corolla* tubular, ventricose; *base* subgibbous; *limb* bilabiate; *lobes* 5, rounded; *stamens* 4, didynamous, included; *anthers* sagittate: *cells* 2, subparallel; *ovary* 2-celled, ultimately falsely 4-celled; *cells* many-ovuled: *capsule* tetragonous, oblong, loculicidally 2-valved; *seeds* numerous, obliquely oblong, exalbuminous.

1. SESAMUM, L.

As above.

1. **Sesamum orientale**, L. SESAMUM OR GINGELLY. **Vern.** Till (H); Til, Tili (M); Yellu (K); Thirr, Til (S); Tal (G). Herbaceous

annual, attaining the height of 4½ feet : *stem* pubescent, puberulous or almost smooth : *leaves* very variable on the same plant, lower most usually 3-lobed, 3-partite or in luxuriant examples pedatisect, upper often narrow and 3-partite or broadly ovate simple, uppermost usually, narrow and entire ; *margins* deeply toothed or lobed : *inflorescence* from all the reduced linear uppermost leaves, consisting of solitary or three clustered flowers, lateral flowers often reduced to glandlike bodies ; *pedicels* short, thick, *bracteoles* when present like sepals : *sepals* lanceolate ; *corolla* up to 1½ inch long, pubescent, pink with yellow marks inside ; *calyx* 1 inch long, pilose, shortly acuminate.

Pollination. Normally self-pollination takes place in the open flowers. Cross-pollination takes place frequently on account of the failure of self-pollination in some flowers due to the anthers turning brown and becoming aborted.

Area. The total area under this crop in the Bombay Presidency was 192,692 acres in 1922-23 and it occupies the second place among oil seeds. Ahmednagar claims no less than 22 per cent. of the area under sesamum, followed by West Khandesh and the Panch Mahals with 13 to 14 per cent. each. Nasik has 10 per cent. and East Khandesh, Bijapur, Ahmedabad and Sholapur grow about 5 to 6 per cent. each of the area in the province.

There are three varieties of sesamum commonly grown, namely **White sesamum, Red sesamum** and **Black sesamum.** The white variety is earlier and also richer in oil, containing about 48 per cent. of oil ; the red and black varieties contain about 46 per cent. of oil. The seeds yield about 40 to 45 per cent. of oil on the weight of seed in the country ghani. The cake makes very good food for cattle containing over 30 per cent. of albuminoids. The stalks of Til are eaten by cattle.

27. **LABIATÆ** (Mint Family).

Herbs, rarely shrubs, usually abounding in oil glands and therefore strong smelling : *stems* generally square : *leaves* simple, opposite or whorled without stipules : *flowers* irregular, usually small, very frequently in whorls ; *calyx* persistent, 4 or 5-cleft, often 2-lipped ; *corolla* tubular ; *limb* 4 or 5-lobed, generally distinctly 2-lipped ; *stamens* 4, didynamous, or 2 arising from between the lobes ; *stigma* usually bifid : *fruit* of 4 small seed-like nuts at the bottom of the calyx tube.

1. **COLEUS,** Lour.

Calyx 5-toothed, 2-lipped, the upper lobe broad, enlarged in fruit ; upper lip of *corolla* 3 or 4-divided, lower much longer, boat-shaped ; *filaments* combined below into a sheath round the style.

1. **Coleus barbatus**, Benth. **Vern.** Gurmal, Garmalu, Maimmul (M, G). A small under shrub, having opposite, softly hairy, notched, ovate, obtuse *leaves* and *spikes* of bright purple 2-lipped flowers.

This is cultivated to a small extent in Baroda, Bassein and other places in Gujarat for its fleshy sweet potato-like roots which are used in pickles.

The following fragrant-leaved plants belonging to this family are cultivated by the malis round about Poona, Bombay, to meet a small local demand for them :—

Mentha spicata, L. (*M. viridis*, Hort). **Vern.** Pudeena (M).

Mentha arvensis, L. MINT.

Mentha piperita, L. PEPPERMINT.

Majorana hortensis, Moench. (*Origanum majorana*, L.) **Vern.** Marva (M).

28. AMARANTHACEÆ

Herbs : *leaves* opposite or alternate, exstipulate : *flowers* usually hermaphrodite or unisexual, small, usually in terminal, simple or panicled cymes or clusters ; *bracts* hyaline and scarious ; *bracteoles* 2, scarious ; *perianth* of 5 persistent, dry, rigid sepals ; *stamens* 1 to 5, opposite the sepals, free or connate below ; *ovary* 1-celled ; *styles* 1-3 : *ovules* one or more, basal : *fruit* an utricle enclosed in the persistent perianth ; *seed* erect, orbicular or ovate, albuminous.

1. AMARANTHUS, L.

Annual herbs : *leaves* alternate : *flowers* monoecious or polygamous, in panicles or in axillary clusters ; *sepals* 5 or 2 or 3, equal or nearly equal, ovate lanceolate ; *stamens* 5 or 2 or 3, free : *ovary* compressed ; *style* short or absent ; *stigmas* 2-3 : *utricle* compressed, indehiscent or circumscissile, apex entire or 2-3 toothed ; *seed* erect orbicular, compressed ; *albumen* floury.

Large annual : *spikes* in large, dense panicles ; *bracts* setaceous or awned ; *sepals* 5 ; *stamens* 5 : *utricle* circumscissile, *apex* 2-3-fid.	1. **A. paniculatus.**
Often tall herb : *spikes* crowded in the lower axils and forming a long narrow panicle ; *sepals* 3 ; *stamens* 3.	
Yielding one crop annually	2. **A. tricolor.**
Yielding several crops annually ..	2a. **A. tricolor** *var.* **tristis.**
A tall, succulent herb : *sepals* 2 or 3 ; *stamens* 2 or 3 ; *bracts* not accuminate : *utricle* indehiscent	3. **A. blitum** *var.* **oleracea.**

1. **Amaranthus paniculatus**, L. **Vern.** Rajgira (M) ; Rajgiri (K) ; Rajagro (G). A tall plant, attaining the height of 6 feet : *stem* stout often reddish, striated : *branches* numerous, erect : *leaves* elliptic lanceolate, acute or acuminate, *base* cuneate : *flowers* innumerable, indense yellow or red spikes, disposed in a very large, terminal drooping panicles ; *bracteoles* acicular, exceeding the sepals ; *sepals* 5, oblong lanceolate, acute shortly awned ; *stamens* 5 : *utricle* circumscissile about the middle ; *seeds* white, red or black.

Cultivated for its floury seed in gardens and fields during the kharif season. The leaves are often used as a pot-herb.

2. **Amaranthus tricolor**, L. (*A. gangeticus*, L.). **Vern.** Math (M). A more slender herb than the last, reaching the height of 4 feet : *stem* stout, branching above the middle, striated smooth : *leaves* very variable, long petioled, ovate oblong or lanceolate, main nerves numerous : *flower clusters* in the axils, and also forming a long, terminal panicle ; *bracteoles* narrowly lanceolate subulate, awned ; *sepals* 3, lanceolate, long awned ; *stamens* 3 : *seeds* black shining.

Cultivated in gardens throughout the year for its leaves which are used as a vegetable.

2*a*. **Amaranthus tricolor**, L., var. **tristis**, Prain. **Vern.** Lal Sag (H).

An annual herb with many prostrate branches from near the base of the stem. The plants spring up after cutting several times in the season. Also cultivated in the same manner and for the same purpose as the type.

3. **Amaranthus blitum**, L., var. **oleracea**, Hooker. **Vern.** Tandulja, Tambada math, Pokla (M). A tall erect, succulent herb : *stem* stout, pale grooved and striate, glabrous : *leaves* ovate obtuse, retuse, glabrous : *flowers* in axillary clusters or the upper in a lax or dense spike ; *bracteoles* shorter than the sepals ; *sepals* 3, linear oblong, obtuse or acute ; *styles* 3, very short : *seeds* brown black, shining.

Also cultivated throughout the year as a pot herb.

Amaranthus polygamus, L. **Vern.** Tandulja, Chavalai, (M). Growing as a weed in irrigated fields or in the monsoon in other fields. It is not separately cultivated, but is collected by weeders for using as a vegetable.

29. CHENOPODIACEÆ

Herbs or shrubs : *leaves* simple, alternate, exstipulate : *flowers* small green, hermaphrodite or unisexual ; *bracts* 1 or absent ; *bracteoles* absent or 2 ; *perianth* of 3-5, free or connate sepals ; *stamens* usually 5 hypogynous or perigynous ; *ovary* 1-celled ; *ovules* solitary basal or lateral ; *style* terminal ; *stigma* capitate, 2-3-lobed : *fruit* usually an utricle, enclosed in the often enlarged fleshy calyx ; *seeds* albuminous or exalbuminous.

Perianth 5-partite, hardly altered in fruit ; *flowers* without bracts and bracteoles ..	1.	**Chenopodium.**
Perianth 5-lobed, *base* thick and hardened in fruit ; *flowers* bracteate and 2-bracteolate ..	2.	**Beta.**
Stem twining : *bracteoles* 2, broad, adnate to the face of the perinath ; *anthers* versatile.	3.	**Basella.**

1. CHENOPODIUM, L.

Tall, erect, mealy herb : *leaves* very variable : *flowers* innumerable, minute, hermaphrodite, forming axillary and terminal, simple or branched spikes or racemes ; *bracts* and *bracteoles* absent ; *perianth* usually 5-lobed,

segments concave, incurved : *stamens* 5 or fewer ; *ovary* depressed globose ; *stigmas* 2 : *embryo* annular, surrounding the floury albumen.

1. **Chenopodium album**, L. **Vern.** Chakvat (M) ; Hunchik (K) ; Fil (S). Sometimes attaining the height of 10 feet, all parts, especially when young, covered with green or reddish meal : *leaves* long petioled rhomboid, deltoid or lanceolate, acute or obtuse : paniculate *spikes* usually large and drooping ; *sepals* closing over the thinly membranous utricle : *seeds* orbicular compressed, shining.

A tall glaucous herb cultivated in gardens as a pot-herb and also occurring as an escape.

2. BETA, L.

Smooth, fleshy herb, with a swollen root : *leaves* radical and alternate, broad and entire : *flowers* hermaphrodite, solitary or in axillary spiked or cymose clusters ; *bracts* distinct ; *bracteoles* 2 ; *perianth* urceolate, 5-lobed, *bases* of *segments* hardened in fruit ; *stamens* 5 ; *disk* fleshy, annular ; *ovary* depressed, sunk in the disk ; *style* short ; *stigmas* 2-4, subulate : *utricle* adnate to the disk and base of perianth ; *seed* with a thin testa and floury albumen.

1. **Beta vulgaris**, L. Beet. Beetroot. Root large, succulent, usually red, sometimes pink or white : *stem* 1-2 feet, erect furrowed : *lower leaves* ovate or oblong, obtuse, *base* cuneate or cordate, *cauline* rhombic ovate oblong or obovate lanceolate : *spikes* up to 18 inches long, slender.

The beetroot is cultivated in gardens throughout the year for the fleshy globose roots which are used as a vegetable.

3. BASELLA, L.

A perennial, slender stemmed, twining, fleshy, glabrous herb : *leaves* alternate, broad, entire : *flowers* spicate, sessile, bisexual ; *bracts* minute, caducous ; *bracteoles* 2, united into a 2-lipped cup and adnate to the perianth ; *perianth* fleshy, 5-fid, ultimately berry-like ; *stamens* 5, on the mouth of the perianth tube ; *ovary* globose ; *ovule* subsessile ; *style* 3, connate at the base ; *stigmas* linear, clavate, papillose within : *utricle* globose, included in the fleshy perianth ; *pericarp* thin, adnate to seed ; *seed* erect, subglobose.

1. **Basella rubra**, L. **Vern.** Poi (H) ; Vel bondi (M) ; Maya-ki-baji (G). *Stems* slender, twining to the right, much branched : *leaves* thick, broadly ovate, acute, or acuminate, *base* often cordate, narrowed into the petiole : *flowers* white or red, in lax pedunculate spikes 1 to 6 inches long ; *segments* or *perianth* elliptic obtuse : *fruit* of the size of a pea, red, white or black.

Grown usually on houses and used as a vegetable. According to Roxburgh (14) there are three cultivated varieties, a red and a white stemmed, that are raised from seed and a larger sort which is always increased by slips.

Atriplex hortensis, L. **Vern.** Chandanbatva (M). A stout erect polygamous succulent annual, often tinged with red or purple : *leaves* not mealy, the lower deltoid, the upper usually ovate lanceolate : fruiting *bracteoles* thin, nearly free, elliptic or orbicular, reticulately veined, obtuse sometimes mucronate.

It is cultivated to a small extent in garden lands and is used as spinach.

30. POLYGONACEÆ

Herb : *leaves* alternate ; *stipules* sheathing the stem : *flowers* hermaphrodite, regular in terminal or axillary cymes ; *perianth* 5-partite ; *stamens* 8 ; *ovary* trigonous ; *styles* 3 ; *stigmas* capitate : *nut* trigonous, longer than the perianth ; *seed* erect ; *albumen* floury.

1. FAGOPYRUM, Gærtn.

As above.

1. **Fagopyrum esculentum**, Gærtn. Buckwheat. **Vern.** Kutu (M) ; Kaspat (H). Annual glabrous herb, with stems 1 to 3 feet high : *leaves* triangular cordate acute : *flowers* pink, in axillary and terminal, many-flowered, subcapitate cymes : *nut* ovate, $\frac{1}{4}$ inch long with 3 acute angles, yellowish brown.

Grown in small quantities as a rabi crop in the Deccan and Gujarat, for the sake of its small nut which is eaten as a grain.

2. RUMEX, L.

1. **Rumex vesicaris**, L. **Vern.** Chuka (M).

An acid annual, much cultivated as a pot-herb used in cooking *Bhaji*.

31. PIPERACEÆ

Scandent shrubs : *nodes* swollen and emitting adventitious roots : *leaves* entire, often unequal-sided, stipulate : *flowers* minute, dicœcious, in catkin-like spikes, each in the axil of a bract, with or without lateral bracteoles ; *perianth* absent ; *stamens* usually 1-4 ; *anthers* 2-celled, the cells distinct ; *ovary* 1-celled ; *stigmas* 2-5 : *berry* small, ovoid or globose ; *seeds* usually globose with a thin testa, albuminous.

3. PIPER, L.

As above.

Leaves large, leathery, 5-7 served : *bracts* orbicular, peltate : *fruit* (rarely produced) very small, in dense cylindric spikes ..	1.	**P. Betle.**
Leaves leathery, 1-nerved, *lower* ovate cordate, long petioled, *upper* oblong cordate, sessile, amplexicaul : *fruiting spikes* short, suberect	2.	**P. longum.**
Leaves leathery, 5-9 nerved : *bracts* of *female pikes* cupular : *fruit* of the size of a pea ..	3	**P. nigrum.**

1. **Piper Betle**, L. **Vern.** Vidyachi Pan (M) ; Vilyedeli (K) ; Pan (G) ; Pan Tamboli (H). A tall dicœcious climber, quite smooth : *leaves* obliquely ovate, oblong or rounded ovate, cordate, 5-7 nerved, *base* often

unequal : *fruiting spikes* (rarely allowed to be produced) pendulous, 1-5 inches long ; *fruit* less than ¼ inch in diameter, often confluent into a fleshy mass.

This plant is cultivated in special structures called *Pan Baris* for the sake of its leaves, which are chewed with betel-nut (**Areca Catechu**). The vines are supported by quickly growing plants, such as **Erythrina indica,** Lamb (Pangara), **Sesbania aegyptiaca,** Poir. (Shevri), **Sesbania grandiflora,** Poir (Agasta) and **Moringa oleifera,** Lamb. (Shevga).

This is one of the chief garden crops of the Presidency. The chief varieties are *Kali* or black, *Pandhari* or white, and *Velchi* or small. The chief centres of cultivation are Dharwar, the Deccan, Kanara and Thana. The best pan leaves are grown in Poona, Satara, Belgaum and above the Western Ghats. A large quantity is exported from these centres to all the chief cities and especially to Bombay.

2. **Piper longum**, L. Long pepper. Vern. Pimpli (H, M) ; Hipli (K) ; Pipal (G) ; Fil, Fildray (S). A smooth prostrate plant : *lower leaves* long petioled, ovate cordate acuminate, 7-nerved, *upper* narrower, oblong cordate, sessile, amplexicaul ; basal *lobes* often unequal : *female spikes* ½ to ⅔ inch long : *berries* about 1/10 inch in diameter, dark green sunk in a fleshy spike.

Occasionally cultivated. Mr. Ryan, formerly Conservator of Forests, Bombay, has found it in a naturalised state in the Thana Forests, whence the fruits are taken to the market. The dried unripe fruits and the roots are employed in medicine.

3. **Piper nigrum,** L. **Vern.** Miri (M) ; Menasu (K) ; Mari (G) ; Gul mirich, Kala mirich, Gulmirien (S). A stout smooth climber : *leaves* leathery, usually broadly ovate, oblong or nearly orbicular, *base* usually rounded and oblique 5-9 nerved : *flowers* often polygamous ; *bracts* of female short cupular, wholly adnate without raised margins : *fruits* red, ¼ inch in diameter in loose interrupted spikes, pulp thin.

Cultivated in the Konkan and North Kanara furnishing the black and white peppers of commerce. It is also found in a wild state in the forests. Total cultivated area is 4,160 acres, of which Siddapur taluka claims 50 per cent. and Sirsi 25 per cent.

32. EUPHORBIACEÆ

Herbs, shrubs or trees : *leaves* usually alternate : *flowers* unisexual ; *perianth* simple or double ; *calyx* with 2 to 5 sepals, free or connate ; *petals* (when present) 5 ; *stamens* few or numerous ; *filaments* free or in branching clusters ; *ovary* superior, 3-celled ; *styles* usually 3 or 4 entire or divided : *fruit* a drupe or capsule, of one of more cells or of 3 cocci ; *seed* single in each cell, attached to or above the middle, with or without an axil, *embryo* straight, flat, in fleshy albumen.

Petals absent.

A small tree with distichous leaves : *sepals* 4 ; *stamens* 4, free ; *styles* 4 : *fruit* fleshy, the size of a gooseberry .. .. .. 1. **Phyllanthus,**

A large or small shrub : *leaves* palmate : *sepals* 3 to 5 ; *stamens* indefinite, in branching clusters ; *styles* 3 : *fruit* capsular of 3 cocci .. 2. **Ricinus.**

1. PHYLLANTHUS, L.

A glabrous tree : *branches* robust, *twigs* slender : *leaves* pinnately distichous : *flowers* minute, densely clustered in the branches ; *sepals* 4 ; *disk* of male flowers annular crenate ; *stamens* 4, recurved ; *filaments* free ; *ovary* ovoid ; *styles*, reflexed, bipartite : *fruit* globose, fleshy, grooved ; *endocarp* bony, 3-4-celled.

1. **Phyllanthus acidus,** Skeels. (*P. distichus*, Muell. Arg.). Otaheite-Gooseberry. **Vern.** Nari, Harfarauri, Narphal (H) ; Harparewri (M) ; Amla (G) ; Kirnelli (K). A small tree : *leaves* obliquely ovate, acute yellowish green, simulating pinnate leaves : *flowers* in clusters or racemes along the branches which become laden with the light yellow gooseberry-like fruit, which is lobed, and grooved, and contains a hard bony core.

Cultivated in gardens, where the fruit is produced twice a year, in April and May and again at the end of the rains. The fruit is extremely sour and usually eaten cooked with sugar. It is also preserved by pickling.

2. **Phyllanthus emblica,** L. **Vern.** Awla (M) ; Amla (H) ; Nellikai (K).

A small rather handsome tree with graceful foliage of very small narrowly oblong leaflets pinnately arranged. It has small round whitish green fruit which is exceedingly acid and produced in great abundance in November and December and used in pickles and preserves. Planted in gardens. It grows wild in hills of Western Ghats and elsewhere. There are two varieties, one with large fruits cultivated in gardens in Gujarat and the other with small fruits grown in the Deccan. Propagated by seeds.

2. RICINUS, L.

A small or large, smooth, annual or perennial bush : *leaves* broad, palmately lobed, serrate : *flowers* in stout, erect monoecious racemes, the lower part male, the upper female ; *disk* absent ; *male flowers* with *calyx* membranous, splitting into 3-5 valvate segments ; *stamens* numerous, in branching clusters ; *pistillode* absent ; *female flowers* with calyx spathaceous, caducous ; *ovary* 3-celled ; *styles* spreading, entire, bifid or bipartite, feathery or papillose : *capsule* of 3, 2-valved cocci ; *seeds* oblong ; *testa* crustaceous ; *albumen* fleshy ; *embryo* with thin, flat cotyledons.

1. **Ricinus communis,** L. Castor-oil Plant. **Vern.** Arend (H) ; Erandi (M) ; Diveli (G) ; Audla (K) ; Ayrunkukri, Heran (S). Usually glaucous : *leaves* usually large, many-lobed and glandular serrate : *flowers* about 1 inch in diameter ; *anthers* bright yellow ; *styles* reddish : *capsule* up to 1 inch long, globose, surface echinate or not ; *seeds* oval, varying

in size and colour, according to variety, usually with a dark ground colour, clouded with lighter shades.

The perennial varieties, which often attain the height of 15 feet, are cultivated throughout the year and are also often found as escapes. The smaller annual varieties are grown during the rabi season.

Area. The total area under castor in 1922-23 was 89,235 acres, about three quarters of which is claimed by the Surat, Ahmedabad, Kaira and West Khandesh districts. The Panch Mahals has about 7 per cent. of the total area and Dharwar about 4 per cent.

The seeds of these contain from 45 to 52 per cent. oil and yield from 40 to 42 per cent. of the oil in the country ghani.

33. URTICACEÆ

Herbs, shrubs or trees : *leaves* usually alternate, stipulate : *flowers* usually minute, monœcious or dicœcious, in cymes or clusters, or on the surface of a fleshy receptacle, or on the inner walls of a closed receptacle ; *stamens* as many as or fewer than the perianth segments and opposite to them ; *ovary* superior, 1-celled ; *style* simple or bifid ; *ovule* solitary : *fruit* simple, free, or composed of a confluent mass of receptacles, perianths and pericarpus ; *seeds* albuminous or exalbuminous.

Tall herb : *leaves* palmate : *flowers* dicœcious ; *sepals* 5 ; *stamens* 5 ; *style* arms 2 : *fruit* a minute nut .. .. .. 1. **Cannabis.**

Small tree : *leaves* palmate : *flowers* monœcious ; *sepals* 4 ; *stamens* 4 ; *style* bifid : *fruits* of heads of small achenes enclosed in succulent perianths .. .. .. 2. **Morus.**

Trees : *leaves* entire : *flowers* monœcious, crowded on enlarged globose or ellipsoid receptacles ; *male flowers* with *perianth* 2-4-lobed ; *stamens* 1 ; *female flowers* with *perianth* tubular, connate and confluent with the receptacle : *fruit* a greatly enlarged globose or ellipsoid receptacle, clothed with the enlarged fleshy perianths and carpels ; *seeds* large, exalbuminous .. .. 3. **Artocarpus.**

A shrub : *leaves* more or less palmately lobed : *flowers* minute, unisexual, on the inner walls of a fleshy receptacle, the mouth of which is closed by imbricate bracts : *fruits* of minute achenes packed on the inner walls of a hollow, fleshy receptacle, the whole forming the inflorescence known as Syconus or, more popularly, fig .. .. .. 4. **Ficus.**

1. CANNABIS, L.

A tall erect, annual herb : *leaves* opposite below, alternate above, upper 1-3, lower 5-11-partite, serrate, palmatinerved ; *stipules* 2, lateral : *flowers* small, dicœcious ; *males* in axillary panicled cymes ; *females* in axillary panicled racemes ; *bracts* convolute, leafy ; *male flowers* with *sepals* 5, imbricate ; *stamens* 5 ; *pistillode* absent ; *female flowers* with *perianth* hyaline, embracing the ovary or absent ; *ovary* sessile ; *styles* central, *arms* 2, filiform, caducous; *ovules* pendulous : *achenes* compressed, crustaceous ; *albumen* unilateral, fleshy.

1. **Cannabis sativa,** L. Hemp. **Vern.** Bhang (H) ; Ganja (G, M, K). A woody herb, 5 feet and upwards in height : *lobes* of *leaves* lanceolate serrate : *flowers* green.

Said to be wild in Central Asia and in the North-West Himalayas. In cold climates the plant is grown for its fibre called hemp and for its seeds which yield oil ; in hot climates it is cultivated for its narcotic principle which is most strongly developed in the female plants which are prevented from being fertilised by the timely removal of the male plants.

Area. The latest records of the areas devoted to Ganja allot 396 acres to Ahmednagar district and 70 acres to Larkana in Sind.

As it yields as excisable product its indiscriminate cultivation is prohibited.

2. MORUS, Tourn.

A shrub : *leaves* alternate, entire, toothed or three-lobed ; *stipules* small, lateral, caducous : *flowers* monœcious, in head-like, short spikes ; *male flowers* with sepals 4 ; *stamens* 4 ; *pistollode* top-shaped ; *female flowers* with *sepals* 4, increasing in size and becoming succulent in fruit ; *ovary* 1-celled ; *style* central, 2-partite ; *ovule* pendulous : *achenes* enclosed in the succulent perianths ; *seeds* subglobose ; *albumen* fleshy.

1. **Morus alba,** L. Mulberry. **Vern.** Tut (M) ; Tuti (K) ; Shetu (G). A large bushy, decidous shrub, as it occurs in our area : *leaves* membranous, ovate or ovate cordate acute, often lobed, *base* 3-nerved : *female spikes* short, ovoid ; *outer sepals* keeled, *inner* flat or concave : *fruiting spikes* red.

Wild throughout North and West Asia. In this Presidency cultivated in gardens sparingly throughout the Deccan where it produces ripe fruits during the hot weather.

3. ARTOCARPUS, Forst.

An evergreen tree : *leaves* coriaceous, entire, penni-nerved : *flowers* monœcious, densely crowded on enlarged, globose or ellipsoid receptacles ; *male flowers* with *perianth* 2-4-lobed ; *stamen* solitary ; *pistillode* absent ; *female flowers* with *perianth* tubular, confluent below with the receptacle : *fruit* a greatly enlarged, fleshy, oblong cylindric or globose, entire or lobed receptacle, clothed with the greatly accrescent, fleshy perianths and carpels ; *seeds* large exalbuminous.

1. **Artocarpus integrifolia**, L. JACK FRUIT. **Vern.** Kanthal (H); Phanas (M); Halasu (K); Phanas (G). A large evergreen tree, all parts nearly smooth: *leaves* dark green, elliptic oblong or obovate acuminate entire or lobed in young plants; *stipules* large, spathaceous: *fruit* up to 2½ feet long, produced on the stems and large branches and sometimes even below the surface of the ground; *anthocarps* pyramidal; *seeds* large oblong.

A tree, believed to be a native of the Western Ghats but cultivated everywhere. It produces its fruit freely only in tracts enjoying a copious rainfall. They ripen towards the latter end of the hot weather. Firminger (6) says that the Jack fruit is not borne, like most other fruits are, from the ends of branches, but upon stout foot stalks projecting from the main trunk and thickest branches of the tree. In no other way, indeed, could its ponderous weight be sustained. The situation of the fruit, moreover, is said to very with the age of the tree, being first borne on the branches, then on the trunk, and in old trees on roots. Those borne on the roots, which discover themselves by the cracking of the earth above them, are held in highest estimation.

2. **Artocarpus incisa**, L. BREAD FRUIT. Firminger (6) in Gardening in India says :—A handsome tree with very large polished green slashed leaves a native of South Sea Islands, Moluccas and Java. The fruit is of an oval form and of the size of a large melon and in general appearance much resembles the jack fruit. Its exterior is not muricated but is marked with slightly prominent areolæ. It is without seeds and when roasted is said to resemble the crumb of new loaf.

It is occasionally cultivated in large private gardens.

4. FICUS, L.

A small tree, with milky sap: *leaves* alternate, stipulate, palminerved, serrate, angled or lobed: *flowers* minute, on the inner walls of the fleshy receptacle, the mouth of which is closed by imbricate bracts; *male* and *female flowers* with *sepals* 4-5; *receptacle* axillary, pyriform.

1. **Ficus carica**, L. FIG. **Vern.** Anjir (H,M,G); Anjuri (K). A small, decidous tree: *leaves* cordate, scabrid, more or less deeply 3 or 5-lobed: surface of ripe *fruit* usually purple brown.

Area. 443 acres of figs are grown to perfection in the Purandhar taluka of Poona district. Grown scattered elsewhere.

34. ZINGIBERACEÆ

Rhizomatous herb: *leaves* radical or cauline, usually membranous: *flowers* hermaphrodite, irregular, spicate or paniculate, bracteate and often bracteolate; *perianth* biseriate, superior, the outer series (*sepals*) 3, free or connate, the inner 3, petaloid, connate; *stamen* 1, perfect, the remainder forming petaloid staminodes; *anthers* linear, 2-celled; *ovary* 3-celled with axil placentas; *style* usually slender with 2 short stylodes crowning the ovary; *stigma* entire or subentire; *ovules* many: *fruit* a

capsule or soft and fleshy, usually crowned by the shrivelled remains of the perianth ; *seeds* with floury albumen.

Flowers hermaphrodite ; *stamen* 1, perfect, remainder reduced to staminodes or absent ; *flowering stem* leafy ; *bracts* brightly coloured, hooded, forming a loose cone ; *corolla tube* funnel-shaped ; *filament* petaloid ; *connective* spurred at the base ; *stigma* 2-lipped : *capsules* 3-valved	1. **Curcuma.**
Flowers in a dense, cone-like spike produced from the root stock ; *filaments* short ; *connective* appendaged upwards	2. **Zingiber.**
Flowers in loose panicles from the root stock ..	3. **Elettaria.**

1. CURCUMA, L.

Stemless herb : *root stock* tuberous, bearing sessile and long stipitate tubers : *leaves* nearly oblong : *flowers* in dense spikes from amongst the leaves, crowned by a coma of enlarged, coloured bracts ; *lower bracts* ovate, membraneous, enclosing several bracteolate fugitive flowers which open in succession ; *calyx* short, cylindric minutely toothed ; *corolla tube* funnel-shaped ; *lobes* usually ovate or oblong, the upper longer and somewhat concave ; *stamen* 1, perfect ; *anthers* not crested ; *cells* contiguous, spurred at the base ; *lateral staminodes* oblong, petaloid, connate with the filament ; *lip* orbicular ; *tip* deflexed ; *ovary* 3-celled ; *style* filiform ; *stigma* 2-lipped ; *lips* ciliate : *capsule* globose, membranous, finally 3-valved.

1. **Curcuma longa**, L. Turmeric. **Vern.** Haldi (H) ; Halad (M) ; Arashana Beru (K) ; Haldhar (G). *Root stock* ovoid ; *sessile tubers* thick, cylindric, bright yellow inside : *tuft of leaves* 4 to 5 feet high ; *leaves* large, oblong, narrowed to the base ; *petiole* as long as the blade : *spikes* appearing in autumn, 4 to 6 inches long ; barren apical *bracts* small, pink, those of the flowers pale green tinged with red, $1\frac{1}{2}$ inch long ; *flowers* as long as the bracts, pale yellow ; upper half of the *corolla tube* funnel-shaped ; *lateral* segments oblong, upper longer, ovate, concave.

In the Bombay Presidency there is an area of five to six thousand acres under turmeric. Satara is the centre of cultivation and claims nearly four-fifths of the whole. Sholapur and Belgaum grow fair areas. Throughout Gujarat the crop is important as a subordinate crop with ginger.

There are two distinct varieties : (*a*) with hard, rich coloured rhizomes chiefly used in dying known as **Lokhandi halad**, and (*b*) with softer, larger, lighter coloured rhizomes which are usually used for eating.

The plant flowers in the autumn.

2. ZINGIBER, Adans.

Herb with horizontal, tuberous rootstock and elongate leafy stem : *flowers* in radical spikes ; *peduncle* elongate ; *bracts* sheathing, scarious

usually one-flowered; *calyx* cylindric, slightly 3-lobed; *corolla tube* cylindric; *segments* lanceolate, upper concave; *stamen* 1, perfect; *filament* short; *anther cells* with a narrow erect as long as themselves; *lip* 3-lobed, purple, as is also the stamens: *fruit* not formed.

1. **Zingiber officinale**, Roscoe. GINGER. **Vern.** Adrak (H); Ala (M); Alla (K); Adu (G), *Rootstock* biennial, bearing many sessile tubers: *leaves* distichous, linear lanceolate: *peduncles* from 6 to 12 inches long; *spikes* oblong; *bracts* suborbicular cuspidate; *flowers* rather small, rarely produced; *lip* and *stamen* of a dark purple colour; *stigma* funnel-shaped, ciliate.

This crop usually occupies from 1000 to 1500 acres annually in the Presidency proper. Ahmedabad, Kaira, Surat, Satara and Thana are the chief centres of cultivation.

Sunth or dried ginger is prepared by soaking the green ginger in water, removing the skin by rubbing and drying the ginger in the sun.

3. **ELETTARIA,** Maton.

Rootstock thick, horizontal, perennial: *leafy stem* long; *leaves* oblong lanceolate, long petiolate: *panicles* decumbent from the rootstock; *bracts* 2-3-flowered; *calyx* striate, cylindric, persistent; *corolla tube* shortly exserted cylindric; *lateral staminodes* of minute teeth; *lip* obovate cuneate, white with purple streaks: *capsule* subglobose or oblong, size of a small nutmeg, marked with many fine vertical ribs; *seeds* small, many, angular.

1. **Elettaria cardamomum**, Maton. CARDAMOM. **Vern.** Elachi (H); Veldoda (M); Elchi (G); Yalakki (K). Attaining the height of 6 feet and upwards: *leaves* pubescent beneath: *panicles* 1 to 2 feet long; *bracts* linear oblong, persistent, $1\frac{1}{2}$ to 2 inches: *capsule* yellowish white; *seeds* black.

Cultivated for the sake of its aromatic seeds in the spice gardens of North Kanara. The flowers appear during the hot weather and the fruits form between June and July.

Area. The area under cardamon is 1500 acres, all in Kanara district mostly in Sirsi and Siddapur talukas of the district. Yellapur taluka grows 100 acres.

35. MUSACEÆ

Tree-like, succulent herbs with short, thick, rhizomes and false stems formed by the concolute sheaths of the leaves: *leaves* petiolate, very large, oblong: *flowers* unisexual, in a decurved compound spadix raising from between the leaves, the upper practically male, the lower female, each hand or division of the spadix enclosed in a purple caducous boat-shaped spathe; *calyx* spathaceous, 3-5-lobed; *corolla* unilateral, as long as the calyx, convolute round stamens and style; *stamens* 5 perfect, the 6th rudimentary or obsolete; *filaments* stout, filiform; anthers 2-celled; *ovary* 3-celled: *fruit* fleshy, indehiscent, oblong or fusiform, trigonous, seldom producing seeds in cultivated plants which are reproduced by offsets.

as above.

1. **Musaparadisiaca,** L., var. **sapientum,** Kuntze. (M. Sapientum, L) PLANTAIN. BANANA. **Vern.** Kela (H); Kela (M); Balehannu (K); Lewiro (S).

A plant represented by a great number of cultivated varieties. In this Presidency it is chiefly grown in the coastal and Ghat districts, where the necessary humidity of the air prevails.

The following are some of the chief forms :—

1. **Red plantain. Vern.** Tambdi Kel. Raj Kel, Ram Kel (M). A tall plant: *leaves* very long, green ; *stalks* with a dull purple tinge : *fruits* usually 4 inches long by $1\frac{1}{2}$ inch in diameter, oblong, cylindric, slightly falcate, tapering a little to either end; *beak* hard; *skin* green with a decided coppery red suffusions; *flesh* yellow.

This known universally as the Bombay Plantain is probably one of the best in India.

2. **Bengali Guji. Cavendishi. Hirvi. Basrai. Guji.** A dwarf, thick stemmed plant : *leaves* short, broad; *stalks* thick and very short : *fruit* sickle-shaped, trigonous, usually $4\frac{1}{2}$ inches long by $1\frac{3}{4}$ inch in diametar ; *skin* yellow with deep green suffusion.

3. **Motheli.** About 9 feet high: *stem* moderately robust, greenish yellow : *base of leaf* very oblique: *fruits* usually 3 inches long by $1\frac{1}{4}$ inch broad, bow-shaped, not tapering, rounded in section; *skin* of a dull cream colour.

4. **Rajeli.** Robust: *stem* yellowish green: *leaves* long and narrow: *fruits* usually 5 inches long by 1 to $1\frac{1}{2}$ inch broad, yellow, more or less planoconvex, gradually narrowing to the stalk ; *tip* contracted, with a distinct hard brown beak.

The dried plantains of Bassein are made from this variety.

5. **Sonkela** or **Safed Elchi, Sahasrafali, Yalakkibali, Sugandhibali.** A pale green tall slender plant: *fruits* usually small, $2\frac{1}{2}$ inches long by inch in diameter tapering to both ends; *beak* distinct, truncate ; *skin* bright yellow.

6. **Ban Kel. Ambel** (*M. paradisiaca*, L.). Whole plant a light bright green: *fruit* usually $5\frac{1}{2}$ inches long by $2\frac{1}{4}$ inches in breadth trigonous, scarcely tapering, beak 1 inch broad, gold colour when ripe ; *beak* moderately distinct; *skin* yellow.

The fruit of this variety is usually cooked as a vegetable.

7. **Lal Elchi. Karanjali. Sonkel of Poona.** *Stem* about 8 feet high, slender, golden: *leaves* fragile, with glaucous suffusion: *fruits* usually 3 inches by $1\frac{1}{2}$ inch, tapering but slightly to either end ; *skin* yellow, distinctly puncate and striolate.

8. **Mhaskel.** *Stem* of deep pink colour, vigorous: *fruit* like **Basrai** but a bit shorter, a swollen fruit, with a thick rind. A more vigorous

grower than **Basrai.** It takes 3 months from flowering to ripening of the fruit.

9. **Govekari.** *Stem* greenish white, strong: *petioles* are very long nearly half as long as the blade, this character is very distinct from the rest.

10. **Pattemadarangabali.** This takes only two and half months from flowering to fruiting: *stem* green: *fruit* like **Bankel** but the stigmatic end thicker and longer; contains *seed* also.

11. **Yellaybali.** *Stem* green: *leaves* narrow: *inflorescence* 6½ feet long fruiting in the upper foot and a half only: *fruit* contains seed. It may be **Lokhandi of Poona.**

The varieties may be classified as early and late as follows:—

Early varieties:—**Basrai, Sonkel, Mhaskel** and **Bankel.**

Late varieties:—**Lalvelchi, Lal** or **Red, Safetvelchi, Mutheli** and **Rajel**

36. BROMELIACEÆ

Herbs with short, leafy stems: *leaves* rigid, tufted, with spiny serrate margins: *flowers* in a terminal, cone-like, globose or ellipsoid spike imbedded in the axil of each bract; *sepals* 3; *petals* 3; *stamens* 6; *carpels* 3: *fruit* formed of the whole inflorescence combined into a fleshy syncarp with a tough, cylindrical central core.

1. ANANAS, L.

As above.

1. **Ananas comosus**, Merr. (*A. sativus*, Schutt. f.). PINE-APPLE **Vern.** Ananas (H, G, M); Ananasa hannu (K).

Pine-apples thrive in the hot moist climates of the Konkan and are grown to a very limited extent in the betel-nut plantains of Kolaba and Ratnagiri districts in sandy loams, in the coastal talukas of Thana and the garden soils of Surat. The quality of the pine-apple is generally poor.

37. AMARYLLIDACEÆ

Perennial herbs: *leaves* radical: *perianth* irregular or regular, biseriate, 6-lobed or partite; *stamens* 6, epiphyllous; *filaments* free or connate; *ovary* inferior, 3-celled; *ovules* many, axile: *fruit* inferior, usually loculicidial capsule: *seeds* few or many; *albumen* fleshy.

The descriptions of the species of the two following genera are extracted from Drummond and Prain (5).

Leaves large, thick and fleshy, densely clustered at the top of a root stalk or short, simple stem spiny at the tip, and usually armed along the edge: *scap* long, terminal, simple or branching towards the apex.

Inflorescence simple, spicate or compound thyrsoid; *stamens* longer than perianth; *filaments* filiform or flattened at base; *stamens* longer; *style* filiform .. .. 1. **Agave.**

Inflorescence laxly paniculate; *stamens* shorter than perianth; *filaments* thickened at base; *style* thickened in the middle .. .. 2. **Furcræa.**

1. AGAVE, L.

Shrubby herbs, with a usually short, woody stock; *leaves* large, thick and fleshy, densely clustered at the top of a root stock or short simple stem with spiny tip and usually spinous serrate margins; *flowers* fascicled on a large, pole-like scape; *bracts* rather small; *perianth tube* somewhat funnel-shaped; *lobes* 6, linear erect or spreading; *stamens* 6; *ovary* 3-celled; *ovules* many, biseriate in each cell; *style* conical, filiform; *stigma* 3-lobed; *fruit* a coriaceous, loculicidal capsule; *seeds* many, flattened obliquely; *testa* black. *Fruit* sometimes replaced by viviparous bulbils.

Leaves in section flat to concave but never channelled throughout; *teeth* large, more or less remote.

Leaves in a lax rosette or tufted, never less than 3 feet in length, broadest in the middle, tapering to both extremities, linear oblong; *neck* not constricted; marginal prickles pointing uniformly downwards; *perianth segments* not constricted towards the tip: *leaf* flattish throughout .. .. 1. **A. Vera Cruz.**

Leaves hardly widened in the middle, very narrow in proportion to their length, linear lanceolate, curving outwards throughout their length; *terminal spine* acicular .. 2. **A. cantala.**

Leaves in a lax rosette or tufted, never less than 3 feet in length, straight; *perianth segments* narrowed from about the middle to the ligulate tip .. .. .. 3. **A. sisalana.**

Leaves in a close globose rosette, never exceeding 3 feet in length .. .. .. 4. **A. Wightii.**

1. **Agave Vera Cruz,** Miller. (Species D of Drummond and Prain). **Vern.** Latia ghaial (M). *Leaves* linear oblong, many, from a short trunk which is hidden by their thickened bases, sage green often very glaucous, early curving upwards, the ends usually more or less recurved and drooping 4-6 feet long, often rather concave at the widest part which is above the middle and attains a breadth of 10 inches and upwards, neck hardly constricted, leaf margins little indented or nearly straight between the prickles, which are broad, stout, black or dark coloured, spreading or decurved, interval between the prickles about $\frac{1}{2}$ inch or less, seldom $\frac{3}{4}$ inch; terminal spine shortly channelled, $\frac{1}{2}$ to 1 inch long, dark brown, not or very shortly decurrent; inflorescence panicles, trichotomous as regard the main branches which are widened and flattened, blossoms in pairs with a subsidiary bud laterally, developed at different level; germen smooth, cylindric, longer than the perianth; perianth

lobes linear lanceolate of a pale amber tint, cup herbaceous, stamens much exserted, anthers ½ inch in length and upwards, pollen dull yellow style very faintly lobed, capsule rather turgid oblong cylindrical, tip rounded, seeds black shining.

Common throughout the Presidency, but more particularly so to the southwards.

Usually used as a fence and often found also in clumps near villages. Fibre the coarsest and the weakest of the Bombay agaves.

2. **Agave Cantala,** Roxb. (Species E. of Drummond and Prain). **Vern.** Ghayal (M); Kalnaru (K); Jangli Kunwara (G). Leaves linear lanceolate in a lax but even tuft from a short ascending rootstock, pale green sometimes glaucous, older darker tinted very narrow in proportion to their length which attains 4 feet and more, the greatest width just above the middle being about 3 inches, usually 2¼ inches, curving gradually outwards from their moderately thick bases or in weak examples bent over almost from their origin, upper surface more or less concave sometimes trough shaped in the lower portion, marginal prickles large for the leaf conspicuous falcate, always ascending, ½ inch in length berry sharp pale brown or garnet coloured, from a small light coloured cushion; terminal spine usually acicular, cylindrical reddish or dark brown, ½ to 1 inch in length; scape with panicle 12 to 18 feet in height; inflorescence borne on flexuous rather slender branches; fascicles 1-2 flowered; germen equalling or shorter than the perianth; perianth lobes bluntly linear lanceolate 1½ inch long, large in proportion to the germen, cup hardly any, lobes divided nearly to their bases, linear oblong obtuse greenish yellow (capsules not available).

More common than the last. Often cultivated over large areas for the sake of its fibre which is good.

3. **Agave Sisalana**, Perrine. (Species G of Drummond and Prain). Sisal Hemp. Leaves 20 to 25, oblong lanceolate, never forming a rosette but closely tufted on the rhizome or on a very short ascending caudex which is completely hidden by their moderately thick bases, the inner making a very sharp angle with the axis, the outer gradually receding but still making less than a right angle, neck not at all constricted, colour deep green, sometimes glaucous, up to 6 feet long, breadth at the widest part which is just above the middle reaching 10 inches, margin with or without prickles, which if present are weak, scattered and pale coloured; terminal spine not channelled, glossy, purple or dark brown; scape 15 feet or more with the panicle, fascicles of blossoms rarely crowded, germen equal to or shorter than the perianth slightly broadened upwards, base of perianth convex and slightly dilated, limb suddenly constricted, narrowly ligulate, tip slightly hooded, style long, very faintly lobed, early protruded (capsule not available). In India this species varies as regards presence or absence of spines on the leaf margins. We have seen (*a*) spines fully developed, (*b*) spines partially and irregularly developed and (*c*) spines altogether absent on the leaves of the same individual plant.

Introduced between 1885 and 1892.

Native country is unknown. It has not yet run wild. Plantations in the Deccan have only been successful under good soil, irrigation and moderate cultivation. The statement that this plant will thrive in poor land under scanty rainfall has been amply disproved by experience.

4. **Agave Wightii,** Drum. and Prain. (Species I in the key and J in the text of Drummond and Prain). **Vern.** Chota Ghaial (M). Leaves ensiform linear lanceolate, very many ; inserted in a compact series on a stout usually conspicuous trunk, which is partly procumbent or throughout ascending, forming a stiff even rosette 3 to 5 feet in diameter, pale green often tinged with ashy grey, base thin broadly amplexicaul, length attaining 3 feet but not more than $2\frac{1}{4}$ feet on an average breadth at the middle, where the leaf is widest, $3\frac{1}{2}$ inches or less, flat or very slightly convex ; marginal prickles rather weak about $\frac{3}{4}$ inch apart, sometimes spreading or erect, but usually consisting of a small brown cushion, carrying a semi-transparent garnet coloured spine which is often sharply recurved parallel to the leaf edge, but ends in a finely barbed hook which invariably points upwards, terminal spine about $\frac{1}{2}$ inch, pale, slightly decurrent ; scape 12 to 15 feet high with panicle, which is oblong, pyramidal, the main branches short trichotomous, fascicled rather crowded, germen nearly spindle shaped rather shorter than the perianth and constricted below it, cup of perianth soon dividing into 6 lanceolate segments each ending in a narrowly ovate lanceolate limb, which is slightly thickened at the obtuse tip and (in dried specimens) obscurely hooded, greenish yellow ; capsule brown ; very broadly turbinate, $1\frac{1}{4}$ to $1\frac{1}{2}$ inch long rostrate by the indurated bases of the perianth lobes, seeds opaque dull charcoal coloured.

Common throughout the greater part of the Presidency and probably the hardiest species. The fibre is equal to that of the last but is of course, shorter.

Amongst the **Agaves** striped varieties are found commonly in **Agave Americana** and **Agave Wightii.** The white stripes are either on the whole leaf or one of them in the centre only. Some time a whole leaf or two is white. These varieties are usually cultivated in the gardens of Poona and Bombay.

2. **FURCRÆA,** Vent.

A shrubby herb : *leaves* densely clustered at the top of the stem, large thick and fleshy, with spiny tip and almost entire margins ; *flowers* on a tall, paniculately branched scape ; *bracts* small ; *perianth* subrotate, 6-partite ; *lobes* oblong, spreading ; *stamens* 6, shorter than the perianth lobes, oblong, spreading ; *filaments* thickened below the middle ; *ovary* 3-celled ; *style* columnar, thickened below the middle with 3 prominent angles ; *stigma* small, faintly 3-lobed ; *capsule* trigonous, loculicidal ; *seeds* many, flattened. *Fruit* often replaced by viviparous bulbils.

Furcræa Sp. (Species I of Drummond and Prain). Leaves 20 to 40, rather sharply ascending from a short, fairly stout trunk forming a compact tuft, obovate lanceolate, bright green, upper surface glossy, perfectly smooth on both surfaces, 4 to 6 feet and upwards in length, breadth at widest parts which is somewhat below the middle $8\frac{1}{2}$ inches, thickness at this point $\frac{3}{4}$ inch or under, hardly constricted at the base which is 4 inches across by $2\frac{1}{2}$ inches or less in thickness, margins irregularly furnished with weak spreading pickles, pale below, rust coloured upwards, occasionally quite spineless, margins involute just below the apex forming for the last $\frac{3}{4}$ inch or less a green canaliculate blunt unarmed acumen. (Inflorescence not available.)

Cultivated in gardens and elsewhere throughout the drier parts of the Presidency but nowhere extensively. Easily recognised by its bright green broad shining leaves.

38. DIOSCOREACEÆ

Herbs with slender annual twining or procumbent stems, bearing large or small subterranean tubers: *leaves* alternate, entire; *flowers* unisexual and dicœcious, small, panicled, racemose or spicate; *perianth* 6-cleft; *male flowers* campanulate, rotate or urceolate; *lobes* short spreading; *stamens* 6, free or connate; *pistillode* thick, fleshy or absent; *female flowers* with perianth segments 6; *staminodes* 6-3 or absent; *ovary* inferior, triquetrous, 3-celled; *ovules* 2 in each cell; *styles* 3, short; *stigmas* entire or bifid; *fruit* a triquetrous loculicidal capsule; *seeds* flat winged or wingless; *albumen* fleshy or hard, bilaminate.

1. DIOSCOREA, L.

As above. Yam. **Vern.** Ratalu (H); Heggenasu (K); Goradu, Konfal (M).

Stems twining to the left; *capsules* longer than broad; *seeds* winged at base only.
Tuber long; *skin* brown; *flesh* white; *stem* with axillary bulbils .. .. 1. **D. bulbifera** *var.* **Sativa.**

Capsules broader than long; *seeds* winged all round; *stems* prickly; *tubers* in clusters, small kidney-shaped .. .. 2. **D. aculeata.**

Stems twining to the right; *capsules* broader than long; *seed* winged all round; *stems* tetragonous, winged or angled. ..
(*a*) *Tubers* white inside and outside.
Tubers oblong or tapering .. .. 3. **D. alata.**
Tubers globose .. .. 4. **D. alata** *var.* **globosa.**

(*b*) *Tubers* purple outside, oblong.
Skin purple and flesh white .. .. 5. **D. alata** *var.* **rubella.**

Skin and flesh both purple .. .. 6. **D. alata** *var.* **purpurea.**

1. **Dioscorea bulbifera,** L., var. **sativa**, Prain. *Tubers* large and long ; *skin* brown ; *flesh* white : slender *stem* and all parts glabrous, bearing bulbils on the axils of the leaves ; *leaves* broadly ovate cordate acuminate or caudate, 7-9 costate ; *male flowers* in copious slender panicles ; *female spikes* not so large ; *capsules* up to 1 inch long and ½ inch broad, membranous.

Mr. Mollison (12) says that this is the commonest of the yams and that the **Bhusra** variety of Gujarat probably belongs to this species. It attains the weight of 8 to 10 pounds, but is considered a coarse, inferior variety.

Dioscorea bulbifera, L. **Vern.** Karanda (M), is a common wild climber of the moister parts, sending up its stems at the beginning of the rains. The tubers are yellow-fleshed and being acrid require special preparation before being used as food.

2. **Dioscorea aculeata**, L. Chinese Yam. Goa potato. **Vern.** Kangar. *Tubers* clustered, white, oval ; *stems* prickly ; *leaves* long petioled opposite, broadly cordate, 7-nerved ; *male spikes* in spreading panicles ; *pistillode* large, globose ; *capsules* 1½ inch in diameter, emarginate ; *seeds* orbicular broadly winged.

Grown in the moister tracts such as the Konkan and North Kanara.

3. **Dioscorea alata**. L. *Tubers* large, generally 2 at each root, oblong or tapering white within and without ; *stems* angled or winged ; *leaves* usually opposite deeply and broadly cordate, dark, shining ; *petioles* stout, often winged : *male flowers* in slender, ascicled spikes ; *capsule* up to 1½ inch in diameter, broadly obcordate, coriaceous ; *seed* orbicular, broadly winged all round.

A garden crop of the Deccan, Konkan and Gujarat.

4. **Dioscorea alata**, L., var. **globosa,** Prain. **Vern.** Kamodio (G). Differs from the type principally in the shape of the tubers.

Mollison (12) says that this variety has white fleshed, rounded tubers which grow to a size of 8 to 10 pounds. The plant has a 6-angled stem. The **Kamodio** variety of Gujarat is considered of good quality. It has a fragrant smell, like Kamod rice when boiled, hence the name.

5. **Discorea alata**, L., var. **rubella** (?). As in type but the oblong tubers are purple outside and the flesh white.

6. **Dioscorea alata**, L., var. **purpurea** (?). *Skin* and *flesh* of tubers both purple.

Mr. Mollison (12) says that this is a local variety of Gujarat. The tubers are long, large in the middle and taper to each end. Good specimens weigh 7 or 8 pounds. One large tuber or two or more smaller ones form at each root. The skin is dull purple. The flesh is tinged with red, but is nearly white at the centre.

39. LILIACEÆ

Bulbous herbs: *leaves* radical; *flowers* hermaphrodite, terminal, umbellate, bracteate; *perianth* petaloid; *sepals* 6, biseriate; *stamens* 6; *ovary* superior, 3-celled; *ovules* usually 2 in each cell; *style* filiform; *stigma* minute; *capsule* small loculicidal; *seeds* few, compressed; *testa* black; *albumen* fleshy.

1. ALLIUM, L.

Bulbs tunicate: *leaves* often fistular; *flowers* small, white, in a terminal umbel subtended by 2 or 3 spathaceous bracts; *perianth segments* free or slightly connate.

Leaves fistular.

Leaves subdistichichous: *umbels* dense, with flowers and bulbils .. .. 1. **A. Cepa.**

Leaves flat.

Bulb short, compound: *umbels* lax, with flowers and bulbils; inner *filaments* 2-toothed .. 2. **A. sativum.**

1. **Allium Cepa,** L. Onion. **Vern.** Piaj (H); Kanda (M); Dungri Kando (G); Ullegaddi (K); Dungari (S). *Bulb* simple ovoid or globose, flattened beneath; *leaves* subdistichous, fistular; *scape* taller than the leaves; *umbels* bearing flowers and bulbils; *pedicels* shorter than the stellate flowers; *sepals* linear oblong; *filaments* exserted, simple or the inner 2-toothed at the base.

This crop is very important in the Deccan especially in the north of the Poona District and in several talukas of the Nasik district, notably Niphad, Sinnar, Dindori and Nasik. It is also grown in certain parts of the Satara district (Walva taluka) and in West Khandesh near Dhulia. In Gujarat it is purely a crop of greenish lands. In the Konkan and in Kánara its cultivation is not tending to spread.

2. **Allium sativum,** L. Garlic. **Vern.** Lasun (H); Lasun (M); Lasun (G); Belloli (K). *Bulbs* compound: *leaves* lancelolate, flat; *scape slender; spathes* long beaked; *umbels* bearing bulbils and flowers; *sepals* lanceolate acuminate; *inner filaments* toothed.

It is an important crop in the Sinnar and Niphad talukas of the Nasik district where it is very carefully cultivated. Elsewhere it is found in small areas all over the Bombay Presidency, the most important centres apart from Nasik, being Dhárwar, Belgaum, Poona and Satara. It is a semi-cold weather crop grown under irrigation

The following plants are also grown in gardens:—

Allium ascalonicum, L. Shallot.

Allium Porrum, L. Leek. These plants are cultivated in gardens where English vegetables are grown.

40. PALMACEÆ

Trees: *stems* erect, unbranched; *leaves* alternate, plaited in bud, pinnatisect, pinnate, bipinnate or fan-shaped; *petioles* sheathing;

flowers uni- or bi-sexual, small, in panicles or spikes which are enclosed in one or more spathes, usually 3-bracteate ; *perianth* of 6 biseriate segments ; *stamens* 3, 6 or numerous ; *ovary* 1-3-celled or of 3 free carpels ; *stigmas* 3, usually sessile ; *ovules* 1 or 2 in each cell : *fruit* a 1-3-celled drupe ; *pericarp* smooth or rough ; *seeds* with hard or ruminate albumen ; *embryo* small in a small cavity near the surface of the albumen.

Stem slender, smooth, annulate : *leaves* pinnatisect ; *upper leaflets* confluent ; *flowers* monœcious ; *fruit* an ovoid drupé, 2 inches long ; *seed* with ruminate albumen ..	1. **Areca.**
Stem rough with the persistent basal parts of the petioles ; *leaves* pinnate, with rigid scattered clusters of pinnæ ; *flowers* dicœcious ; *fruits* 1 inch long, oblong cylindrical, 1-seeded	2. **Phoenix.**
Stem flexuous, annulate ; *leaves* large distichously pinnate ; *fruit* a large, ovoid drupé with a fibrous covering, 1-seeded	3. **Cocos.**
Leaves fan-shaped : *stem* columnar, annulate or occasionally invested with the remains of the petioles : *flowers* dioecious ; *male flowers* sunk in thick catkin-like branches ; *female* large : *fruit* large, with 1 to 3 large pyrenes ..	4. **Borassus.**

2. ARECA, L.

Stem simple annulate : *leaves* pinnate ; *upper pinnae* confluent ; *spathe solitary*, compressed ; *spadix* branched ; *rachis* stout, compressed infrafoliar ; *flowers* monœcious ; *male flowers* many, minute ; *sepals* 3 ; *petals* 3, oblique lanceolate, valvate ; *stamens* 6 ; *female flowers* much larger than males, few at the base of the branches ; *perianth* accrescent ; *sepals* and *petals* orbicular ; *ovary* 1-celled ; *stigmas* 3, sessile ; *fruit* ovoid ; *seed* with ruminated albumen.

1. **Areca Catechu**, L. BETEL NUT. **Vern.** Supari (H, M, G) ; Adiki (K). *Stem* smooth, shining, up to 80 feet in height ; *leaves* 4 to 6 feet in length ; *leaflets* numerous, bright green ; *fruit* up to 2 inches in diameter, orange or scarlet.

Cultivated throughout the Konkan and more particularly in the Sirsi and Siddapur tàlukas of North Kánara. It usually flowers in March or April and the fruits ripen in November and December. A good tree is said to produce 200 to 400 fruits annually for 30 or 40 years.

Area. The total area under betelnut in 1922-23 is about 22,211 acre most of it (practically 82 per cent.) being claimed by Kánara. Ratnagiri grows 3,821 and Kolaba 371 acres.

Diseases. The Areca palm is subject to a disease called Koleroga which causes extensive destruction in Kánara. The cause of the disease is the fungus *Phytopthora areca*. The symptom is the rapid dropping

down of immature nuts. The loss amounts to from 25 to 75 per cent. of the yield. The remedy is to spray the inflorescence before the nuts are formed with Resin-Bordeaux mixture. This must be done at least a week before the rains start.

2. PHŒNIX, L.

A moderately tall palm : *stem* stout, rough with the persistent bases of spiny petioles ; *leaves* pinnate ; *pinnae* scattered, rigid, lanceolate ; *spalices* several, interfoliar, erect, afterwards drooping, branched ; *spathe* basilar ; *flowers* small, dicœcious ; *male flowers* with *sepals* or *perianth* cupular, 3-toothed ; *petals* 3, obliquely ovate, valvate ; *stamens* 6 ; *female flowers* with *sepals* 3, globose, accrescent ; *petals* 3, rounded, imbricate ; *staminodes* 6, free or connate ; *carpels* 3, free ; *stigmas* sessile, hooked ; *perianth* fleshy ; *fruit* oblong, terete , 1-seeded ; *endocarp* membranous ; *seed* oblong, ventrally grooved, *albumen* equable or sub-ruminate.

1. **Phœnix sylvestris,** Roxb. Wild date or toddy Palm. **Vern.** Khajuri (H) ; Shindi (M) ; Kharik (G) ; Ichal (K). A tree 30 to 40 feet high ; *leaves* 10 to 15 feets long ; *leaflets* 1-2 feet long in fascicles ; *petioles* spiny ; *male spadix* 2 to 3 feet long ; *fruit* yellow, about 1 inch long.

Common wherever there is moisture throughout the dry parts of the Presidency. It is abundant as a wild or self sown plant and is also cultivated extensively for the sake of its sugary sap which is fermented and drunk as a liquor. Flowers appear in the cold weather, and the fruits, which are edible, ripen at the beginning of the rains in June.

2. **Phœnix dactylifera,** L. Date Palm. **Vern.** Khajur, Kharik (M) ; Khajjuri, Uttatti (K) ; Kharakiya (G).

Cultivated in Sind only.

Varieties of date grown in Rohri and its neighbourhood, Sind :—

1. **Lohar.**
2. **Assuli.**
3. **Thottiar.**
4. **Idulshahi.**

Of these the first two are superior varieties whose suckers cost as much as from Rs. 5 to Rs. 15 each.

Pollination. When the trees mature artificial pollination is carried out. In the pollination season of 5 weeks, from 20th February to 30th March, the male spathes are gathered ; pieces of the spathes are then carried up the female trees whose inflorescences are dusted with pollen. For the purpose of effective pollination of all flowers a female tree has to be visited eight to twelve times in the pollination season.

It is interesting to note that 17 male trees are planted in a garden of 400 female trees, *i.e.* about 4 per cent.

3. COCOS, L.

Tall palm with flexuous, annulate, grey stem : *leaves* large, with closely set, long narrow pinnae ; *spadix* paniculate, erect at first, afterwards

drooping, branches bearing scattered female flowers, often between two males towards their bases and males above ; *spathes* 2 or more, the lower short, the upper fusiform or clavate ; *male flowers* unsymmetric ; *sepals* 3, small, velvate ; *petals* 3, oblong, acute, valvate ; *stamens* 6 ; *female flowers* usually much larger than males ; *perianth* greatly accrescent ; *sepals* 3, imbricate ; *petals* 3, shorter, convolute, with imbricate tips ; *disk* annular or absent ; *ovary* 3-celled, usually one-ovuled ; *style* short terminal ; *stigmas* recurved : *fruit* large, ovoid, terete or trigonous, 1-seeded ; *pericarp* thick, fibrous ; *endocarp* hard, with three basal pits, the remains of the three cells ; *seed* cohering with the endocarp ; *albumen* lining the endocarp, with a thick hard coat ; *embryo* opposite one pit.

1. **Cocos nucifera,** L. Cocoanut Palm. **Vern.** Narial (H) ; Naral (M) ; Tenginakai (K) ; Naliar (G). A tree attaining the height of 80 feet : *leaves* 12 to 18 feet long ; *leaflets* 2 to 3 feet long, flacid ; *petiole* 3 to 5 feet, stout : *drupe* 4 to 10 inches long.

Planted in large groves along the coast and often seen in the inland districts as an ornamental plant. The flowers appear throughout the year and the fruits ripen within a year.

It is a tropical crop being found in the countries and inland bordering on the Indian and Pacific oceans, and it is from the Islands and sea coasts in the more tropical parts of these oceans that the world's supply is chiefly derived. Only the southern part of the Bombay Presidency is sufficiently tropical to grow cocoanut as a commercial crop and hence the total area under cocoanut is only about 28,000 acres, 50 per cent. of which is found in Ratnagiri, 40 per cent. in Kanara and 3 per cent. each in the Thana and Kolaba districts. The plants yield toddy also by tapping.

Pests. Rats are a serious pest to cocoanut trees. Circular holes are cut by them just outside the woody calyx of the nut before it has developed the hard shell covering the copra. The sweet milk and the tender flesh (copra) inside the nut is thus approached by them. Nuts so affected fall down in large numbers. The remedy is to fix tin cones not less than 6 inches wide, round the trunk by means of nails. The rats find it impossible to get across them. For further details *vide* Leaflet No. 2 of 1917 of the Department of Agriculture, Bombay.

4. BORASSUS, L.

A tall dicœcious palm with a black stem annulate when naked but occasionally the bases of the petioles of the leaves persist for years : *leaves* large, fanshaped ; *petioles* spiny : *spadices* large, simply branched ; *spathes* several ; *male flowers* sunk in cylindrical, catkin-like branches, small ; *sepals* 3, narrowly cuneate, *tip* inflexed truncate ; *petals* 3, shorter than sepals, obovate spathulate ; *stamens* 6 ; *female flowers* scattered, solitary on a sparingly branched spadix, larger, than the males, globose ; *perianth* fleshy, greatly accrescent ; *sepals* 3, reniform, imbricate ; *petals* 3, smaller, convolute ; *staminodes* 6-9 ; *ovary* globose, subtrigonous, entire or three to four-partite, 3-4-celled ; *stigmas* 3, sessile, recurved : *fruit* a large globose drupe, with 1 to 3 obcordate pyrenes ; *pericarp* thin, fleshy ; seeds oblong, top 5-lobed ; *albumen* equable, hollow.

1. **Borassus flabellifer,** L. PALMYRA. **Vern.** Tari (H); Tad (M); Talemara (K); Tadnujhad (G). *Stem* 60 to 70 feet high: *leaves* 6 to 10 feet in diameter, rigid: *drupe* broadly obovoid up to 8 inches in diameter.

Planted throughout the Presidency and extensively abundant in the Konkan near Bombay. The sugary sap is fermented and used as liquor and during the hot weather the unripe seeds called *Tad Gola* are sold in the market.

Gul manufacture. The juice derived from the cocoanut palm, shindi palm, the toddy palm, *i.e.*, **Borassus flabellifer** L., and also from the fish tail palm, **Caryota urens**, L., has been experimentally manufactured into gul with success. Some Parsi families in Umbergaon Peth, District Thana, occasionally manufacture gul from date palms.

Pests. All the palms are attacked by the Rhinoceros beetle which damages the trees by boring into the soft crowns. Its grubs live in old decaying wood of palms and other trees. The remedy is to destroy by burning dead and rotten palm stems and heaps of rotten vegetable matter lying about in the vicinity.

The Palm Weevil. This weevil called the Red Weevil (*Rhynchophorus signaticollis*, Chever) is a slender insect of red-brown colour, with a conspicuous curved snout, about 1½ inches long. The insect lays eggs in the wounds made by the Rhinoceros Beetle, in cuts made by tapping or in cracks or at base of leaves, etc. The grubs that hatch tunnel in the soft tissues of the plant which thereby dies. The remedy is (1) to destroy the Rhinoceros beetle; (2) all cuts made by tappers or otherwise should be so treated as to prevent egg laying. In Gujarat the cut is smeared with the juice of **Euphorbia nerifolia** (**Vern.** Thor); clay may also be used; (3) Burn the badly attacked and dead trees.

41. ARACEÆ

Herbs, with a short stock or corm, stemless: *leaves* clustered or solitary, radical, appearing with or without the flowers; *petioles* with a sheathing base, simple or compound: *flowers* unisexual, monœcious, sessile on a spadix which is more or less enclosed in a spathe, with male flowers towards apex and female flowers towards base; *perianth* absent; *stamens* in male flowers 1 or more; *ovary* 1-3-celled; *ovules* in each cell 1 or more: *fruit* of many, small, free or connate berries or drupes adnate to the spadix; *seeds* usually albuminous.

Leaves trisect, with pinnatifid segments: *flowers* appearing before the leaves; *spathe* large, campanulate; *spadix* robust; appendix large, conical ..	1.	**Amorphophallus.**
Leaves simple, ovate cordate, peltate: *limb* of spathe narrow lanceolate ..	2.	**Colocasia.**

1. AMORPHOPHALLUS, Blume.

Tuberous herb: *leaves* solitary, long petiolate, trisected; *segments* pinnatisect: *spathe* large, campanulate; *spadix* robust; *appendix*

large, conical, sinulately lobed ; *neuter flowers* absent ; *male flowers* with *stamens* 2 to 4 ; *anthers* sessile ; *cells* oblong ; *pores* apical ; *female flowers* with *ovary* globose, 1-4-celled ; *ovules* solitary in each cell subbasal ; *style* longer than ovary ; *stigma* 2-4-lobed : *fruit* of small berries ; *seeds* exalbuminous.

1. **Amorphophallus campanulatus,** Blume. Elephant's Foot. **Vern.** Ol ; Suran (M, G, K). Corm attaining its complete development in 4 years, usually 8 to 10 inches in diameter, and weighing from 10 to 20 pounds : *leaf* usually solitary (appearing annually for three years, in the fourth or fifth the inflorescence precedes the leaf) ; *petiole* dark green with pale blotches, up to 3 feet long, erect ; *leaf* horizontal up to 3 and 4 feet broad ; *segments* simple or forked : *spathe* at first with a short stalk, lengthening in fruit, 6 to 10 inches in diameter at the top, campanulate, fleshy folded below, margin crinkled, outer surface smooth greenish with white spots below, greenish purple above, inner surface dark purple and rough ; *appendix* dark purple, up to 6 inches in diameter.

Cultivated in garden lands for its corm, and most generally so in Gujarat, in the valley of the rivers Tapti, Purna, Ambica. The corms keep good for some time if kept in a dry place.

2. COLOCASIA, L.

Leaves clustered, rising from a corm ; *petioles* stout ; *blades* ovate cordate, peltate : *flowers* appearing with the leaves ; *spathe* stoutly peduncled ; *tube* thick, accrescent, mouth constricted ; *limb* erect, deciduous ; *spadix* shorter than the spathe, stout or slender ; *male* and *female flowers* with interposed flat neuters ; *appendage* cylindric, subulate or absent ; *male flowers* with *stamens* 3 to 8 connate in a column ; female *flowers* with ovary ovoid, 1-celled ; *ovules* many on 3 parietal placentas ; *stigma* sessile, discoid : *fruit* of small berries ; *seeds* albuminous.

1. **Colocasia Antiquorum,** Schott. **Vern.** Kachu (H) ; Alu, Pantra or Pandala for leaves, Alvi for corms (G) ; Alu (M) ; Shyami (K). Leaves 6 inches and upwards in diameter, dark green, sometimes clouded with black, peltate, ovate cordate distinctly veined : *tube* of spathe oblong ; *limb* narrow lanceolate cordate acuminate, pale yellow.

Cultivated for the sake of its corms, leaf stalks and leaves, throughout the Presidency. There are at least 2 varieties, one with dark purple stalks and leaves and the other in which these are green.

42. GRAMINEÆ

Roots fibrous, the larger species also supported by adventitious roots, from the lower joints : *culms* hollow or solid, jointed : *leaves* alternate, usually long and tapering, longitudinally parallel veined ; *margins* often invested with minute, forward pointing cutting hairs ; *sheath* embracing the stem, bearing a ligule at its apex : *inflorescence* terminal, in panicles, racemes and spikes, the ultimate divisions of locustæ or spikelets, each *spikelet* consisting of three or more scaly *bracts* called *glumes* of which the 2 lowest are empty, the 3rd and 4th and succeeding glumes (if present)

are called the *flowering glumes* and each of these encloses a pale; the actual *flower* is contained within the pale; *perianth* is represented by 2 (rarely 3 or 6) minute fleshy scales called *lodicules*; *stamens* are normally 3 (rarely 1, 2 or 6); *filaments* thread-like and pendulous; *anthers* versatile; *pollen* dry; *ovary* with one ovule; *styles* 2, feathery: *fruit* a seed-like grain, with the pericarp not separable; *embryo* minute, outside the copious floury albumen at the base of the seed.

Spikelets articulate on their pedicels, or deciduous with them. One or two-flowered, upper flower alone (if two) fruiting.

Spikelets arranged on one side of a flattened rachis, dorsally flattened; *glume* I minute or absent	1.	**Paspalum.**
Spikelets panicled; *glume* I usually much smaller than the others	2.	**Panicum.**
Spikelets spicate, each surrounded by an involucel of bristle	3.	**Setaria.**
Spikelets spicate, fascicles surrounded by an involucel of bristles	4.	**Pennisetum.**
Spikelets panicled; *glume* I and II minute, III and IV equal; *stamens* 6	5.	**Oryza.**
Male spikelets in terminal panicles; *female flowers* in lateral spadices closely invested by tightly sheathing spathes	6.	**Zea.**
Spikelets in large, terminal, cotton panicles	7.	**Saccharum.**
Spikelets in dense or loose panicles binate (one sessile, the other pedicelled)	8.	**Andropogon.**

Spikelets continuous (not articulate) with their pedicels, 1-many-flowered; *rachilla* articulated at the base and often between the flowering glumes, lowest flower always fruiting, upper often male or neuter.

Spikelets in loose panicles 2-6-flowered; *flowering glume* awned; *awn* subterminal or dorsal	9.	**Avena.**
Spikelets in digitate spikes, 3-6-flowered, densely crowded	10.	**Eleusine.**
Spikelets distichously spicate, in clusters of 3, 2-5-flowered	11.	**Triticum.**
Spikelets spicate, one-flowered, in clusters of 2 or 3, lateral often imperfect	12.	**Hordeum.**

1. PASPALUM, L.

A smooth annual grass: *stems* numerous and branching, 1 to 2 feet high, compressed: *spikelets* broadly oblong, 1-flowered, arranged on one side of a flattened rachis, on the branches of a simple raceme, usually 2-ranked, plano-convex; *glume* I absent; *glume* II convex, 3-nerved; *glume* III equal to II, flat, 5-nerved; *glume* IV tough, with inflexed auricled margins.

1. **Paspalum scrobiculatum,** L. **Vern.** Kodra (H) ; Kokra, Harik (G) ; Harik (K) ; Kodra (M). Growth often decumbent : *leaves* acuminate, often exceeding the inflo escence : *rachis* $\frac{1}{8}$ inch in diameter : *grain* brown, free within the hard ned glume.

Pollination. Ninety per cent. of the flowers are cleistogamous.

Cultivated as a kharif crop. The total area in 1922-23 was 245,911 acres. Gujarat claims the largest area. Elsewhere it is chiefly grown in Ratnagiri, the uplands of the Konkan and the ghat parts of the Deccan.

2. PANICUM, L.

Annual grasses : *spikelets* small, articulate on their pedicels, very rarely awned ; *glumes* I and II empty, epaleate, I smallest and fewest nerved ; *glume* II and III usually subequal, 3-many-nerved, oblong, ovate or lanceolate ; *glume* III paleate or not, triandrous or neuter ; *glume* IV paleate, bisexual, oblong ovate or lanceolate, hardened in fruit, glabrous, dorsally convex ; *palea* 2-nerved, membranous or hardened in fruit ; *lodicules* 2, cuneate or quadrate, rarely absent ; *stamens* 3 : *grain* free, within glume IV and pale.

Spikelets crowded on the under-surface of a congested panicle ; *glume* I half as long as IV or shorter ; *glumes* II and III strongly nerved, cuspidate ; *glume* IV hard in fruit .. .. .. 1. **P. Crus-galli** *var.* **frumentaceum.**

Spikelets scattered on the spiciform branches of a loose panicle ; *glume* I half as long as III ; *glumes* II and III subequal ; *glume* IV rugose ; *pedicels* hairy ; *awn* absent .. .. .. 2. **P. ramosum.**

Spikelets pedicelled on the branches of a decompound panicle.

(*a*) *Glume* I = $\frac{2}{3}$ III ; *glume* IV smooth and shining. Pedicels glabrous .. 3. **P. miliaceum.**

(*b*) *Glume* I = $\frac{1}{3}$ III .. .. 4. **P. miliare.**

(*c*) *Glume* I = $\frac{1}{4}$ III .. .. 5. **P. maximum.**

1. **Panicum Crus-galli,** L., var. **frumentaceum,** Trim. **Vern.** Banti (Surat District) (G) ; Barti or Banti (M). A tufted annual, smooth or hairy, height 2 to 4 feet : *leaves* amplexicaul, linear lanceolate from a rather broad base, scabrous above, smooth below, margins with cutting hairs ; *sheaths* rather loose ; *ligule* obsolete : *panicle* contracted, oblong, 6 inches or more long ; *branches* racemose, ascending and curved inwards ; *spikelets* densely crowded on the upper surface, 1-10 to 1-12 inch long by 1-12 inch broad ; *glume* I $\frac{1}{3}$ III, orbicular apiculate, margins incurved at base, these and the 3 nerves ciliate ; *glume* II equal to III, broadly ovate, tip rounded shortly mucronate, 3-nerved, nerves ciliate on the back ; *glume* III equal to II paleate, male or neuter 5-nerved, tip acute

mucronate ; *glume* IV ovoid, a little shorter than III, bisexual, and with its pale, coriaceous, shining white.

Mollison (12) says that the chief centres of this crop are Ahmedabad and the Panch Mahals in Gujarat. Elsewhere in the Presidency the cultivation is trifling. Throughout the Deccan, on light land, with a fair rainfall it is widely grown in little patches, often as a border with other crops.

2. **Panicum ramosum,** L. **Vern.** Dhengli (M). An erect annual with decumbent base, attaining the height of 3 feet, almost glabrous : *leaves* amplexicaul, cordate at base, 3 to 4 inches long narrowly lanceolate, scabrid above, margins cutting ; mouth of *sheath* white cilliate ; *ligule* short : *panicle* up to 6 inches long ; *branches* spicate, drooping, rather distant ; *spikelets* sessile, alternate, closely set or scattered ; *pedicels* short, with a few long, weak hairs ; *spikelets* $\frac{1}{10}$ inch long, ovoid glabrous, *glume* I equal to $\frac{1}{2}$ III, broadly ovate, with margins incurved below, apex shortly apiculate, nerves 3, meeting below the apex ; *glume* II equal to III, 7-nerved, ovate, margins slightly incurved ; *glume* III equal to II, paleate neuter, *pale* narrow ; *glume* IV and its *pale* ovoid, coriaceous transversely wrinkled, tightly enclosing the dull white grain.

A common wild grass. An area of about 400 acres is said to be cultivated with this as a grain crop in the Akola Taluka of Ahmednagar.

3. **Panicum miliaceum,** L. **Vern.** Ghoti sava, Vari, dudha vari, cheno, Dhengli (Sangamner), vara (Saswad) (M) ; Chino (S). Annual : *stems* leafy, 2 to 4 feet high : *leaves* rather broad, hairy ; *sheaths* loose, clothed with long, spreading hairs ; *ligule* of long hairs : *panicle* up to a foot and more in length, nodding, branches filiform ; *pedicels* as long as or much shorter than spikelets ; *spikelets* green ultimately becoming golden, $\frac{1}{8}$ inch long, ovate oblong cuspidate ; *glume* I equal to $\frac{2}{3}$ III, 5-7-nerved, ovate acuminate, margins incurved at base ; *glume* II equal to III, 7-11 nerved, ovate acuminate, margins incurved at both apex and base ; *glume* III equal to and similar to II, paleate, neuter, pale small ; *glume* IV broadly ovate bisexual and with its *pale*, yellowish white, coriaceous.

4. **Panicum miliare.** L. **Vern.** Vari ghudi, Halvi vari, Sava, Vari, Vari mahan (M) ; Gadro, Kuri (G) ; Save, Baragu (K). A plant greatly resembling the last in appearance but smoother : *panicles* denser and more compact ; *spikelets* smaller and rounder ; *glume* I scarcely $\frac{1}{3}$ the length of III. Self-pollinated.

The cultivation of these two millets is almost limited to the Konkan and the Ghats of Nasik, Poona, Satara, Belgaum and Dharwar.

5. **Panicum maximum,** Facq. GUINEA GRASS. Perennial, densely tufted : *leaves* long, nearly glabrous ; *sheaths* long ; *mouths* villous ; *ligule* of long hairs : *panicles* large, decompound, lower branches whorled, usually hairy ; *pedicels* unequal, capillary ; *spikelets* $\frac{1}{10}$ inch long, solitary or in pairs, elliptic oblong acute or obtuse, glabrous ; *glume* I equal to $\frac{1}{4}$ III, white ; *glumes* II and III unequal, 3-7-nerved, III paleate male ; *glume* IV elliptic sunacute, transversely rugulose.

A native of Tropical Africa and cultivated under irrigation near large towns in this Presidency as a fodder grass.

3. SETARIA, Beauv.

Spikelets smooth, one-flowered, awnless shortly stalked, articulate and clustered on the very short branches of a spiciform panicle, subtended by persistent involucels of few or many barbed bristles (barren branchlets) which are usually connate at the very base ; *glumes* 4, membranous, with the exception of IV which becomes bony ; *glume* I equal to $\frac{1}{3}$ III or shorter ; *glume* II equal almost to IV ; *glume* III neuter, paleate ; *glume* IV at first coriaceous, becoming bony, plano convex, bisexual paleate, *pale* coriaceous triandrous ; *styles* distant, penicillate at the tips : *grain* small, free, but permanently enclosed within the thickened *glume* and pale.

Short, densely tufted : *spike* erect, narrow ; *bristles* 6 to 8 to each spikelet ; *glume* IV transversely rugose	1. **S. glauca.**
Taller, not densely tufted : *spike* drooping, broader and longer ; *bristles* 1 to 9 ; *glume* IV quite smooth	2. **S. italica.**
Spikes pale, with short or no bristles ; *secondary spikes* arranged spirally, surfaces convex, beneath at the base of each branch more than $\frac{1}{2}$ the length ..	2a. **S. italica** (type).
Spikes pale, with long bristles ; *secondary spikes* too closely aggregated to show a spiral arrangement, form thus cylindrical.	2b. **S. italica** *var.* **barbata.**
Spikes purple brown, uppermost branches only crowded ; *secondary spikes* much laxer than in 2 a ; breadth at the base of each branch equal to $\frac{1}{2}$ or less than $\frac{1}{2}$ the length	2c. **S. italica** *var.* **purpurea.**
Spikes brown, crowded, cylindrical or slightly club shaped, broad at apex, almost quite erect ; *bristles* only slightly exceeding the spikelets	2d. **S. italica** *var.* **typhoidea.**

1. **Setaria glauca,** Beauv. **Vern.** Barati (M) (as a crop). One to two feet high, densely tufted : *leaves* pale green, rather weak and narrow, smooth below, scabrous above ; *ligule* minute, 3-4-sected, $\frac{1}{32}$ inch : *spikes* erect yellow, narrow, completely cylindrical (the lower half often barren), 1 to 6 inches long by $\frac{3}{8}$ inch broad including the bristles, which are yellow $\frac{1}{4}$ inch long, pointing upwards, barbed, 6 to 8 to each spikelet ; *spikelets* $\frac{1}{8}$ inch long, green, sessile on the slender axis of the cylindrical spike ; *glume* I minute ; *glume* II equal to $\frac{1}{2}$ IV, 3-nerved ; *glume* III equal to IV, coriaceous transversely rugose, smooth, white, the *pale* also white.

Cultivated as a kharif crop only in the Mulsi Petha of Poona District. Sown in June, ripens in September.

It is common throughout the Presidency as a pasture grass on rich and cultivated lands. It is considered a fairly good green fodder in India. In Australia and the United States it is highly valued as a fodder and in the latter country it is known by the name of Pigeon and Bottle Grass. Vernacular names as a wild grass are Bandra, Bandri (H); Bhadli (M).

2a. **Setaria italica,** Beauv (type). Italian Millet. **Vern.** Bhadli (Nasik, Ahmednagar); Rala and Kang (generally in the Bombay Presidency). Attaining the height of $4\frac{1}{2}$ feet: *culm* yellow, moderately robust; *nodes* tumid, smooth; *internodes* white, short; *sheaths* smooth, longitudinally closed striate, margins ciliate; *ligule* 1/16 inch high, irregularly partite and fimbriate: *leaves* 12 to 18 inches long by $\frac{1}{2}$ to 1 inch broad, light green in colour, linear lanceolate acuminate, base slightly suffused with brown; *blade* with both surfaces scabrous, midrib distant, white strong, lateral nerves 5 on each side, weaker nerves numerous, indistinct; *flag* with a long sheath; *blade* shorter than or exceeding the inflorescence: *peduncles* long and slender; *spike* curved and nodding, up to $8\frac{1}{2}$ inches long, $1\frac{1}{4}$ inches broad, including the very short bristles (which however in poor examples are often longer, while they are altogether wanting in luxuriant plants) lower branches only slightly scattered, upper densely aggregated, all distinctly arranged in a spiral manner with a convex surface; *rachis* creamy white densely white pilose; *spikelets* slightly secund on the branches yellowish green in clusters of 40 to 50; *bristles* few, white, only attaining $\frac{3}{8}$ inch in length, pointing upwards spikelets ovoid, slightly constricted near base; *glume* I equal to $\frac{1}{3}$ III ovate, 3-nerved below apex; *glume* II shorter than IV elliptic 5-7-nerved; *glume* III almost equal to II epaleate, 5-7-nerved; *glume* IV pale yellow, protruding when ripe.

2b. Var. **barbata.** Differing from the type in the following points:— *spike* up to 9 inches long but usually much shorter, the two lowest branches often remote, the upper more densely aggregated and scarcely showing the spiral arrangement; *spikelets* distinctly secund on the branches, in clusters of 12 to 16; *bristles* 3 to 9 at the base of each spikelet, 5/16 inch long, often almost altogether absent in the uppermost spikelets; *spikelets* $\frac{1}{8}$ inch long, constricted near the base, as in the above; *glume* IV and *pale* white.

2c. Var. **purpurea.** **Vern.** Rala, Bhadli (Ahmednagar, Sholapur and Khandesh). Differing as follows from the above named varieties: *internodes* yellow, suffused with brown: *bases* of *leaves* distinctly brown; *leaves* dark green: *spikes* up to 9 inches long, the smaller sometimes erect, the large invariably curved and drooping, lower branches slightly scattered, centre loosely and uppermost densely aggregated; *rachis* suffused with brown purple, densely setose with white hairs, secondary spikes with almost 20 spikelets in each; *bristles* usually single almost $\frac{1}{2}$ inch long, brown; *spikelets* as above; *glumes* I, II and III suffused with purplish brown; *glume* IV bright yellow, ultimately becoming orange red: *grain* white as usual.

The three varieties are known by the following general vernacular names, Kangni and many other names : Cheno (H) ; Kang (G) ; Kang, Rala, Cheno (M) ; Navani, Vavani (K) ; Keraing, Kangoni (S).

2*d*. Var. **typhoidea.** Height 3½ feet : *leaves* about 18 inches long and ¾ inch broad : *spikes* purple brown, cylindrical or slightly club shaped, broad at apex, length 5 inches, breadth 1 inch ; *bristles* slight-exceeding the spikelets ; *glume* III narrower and more acuminate than in the other varieties.

Received from Sind under the name of Cheno. No information regarding its precise distribution is as yet available.

In the Bombay Presidency, **Setaria italica,** Beauv. is grown in Gujarat, Deccan, Konkan and the Karnatak. The varieties must occur more or less mixed in the fields as in the sample plots raised from grains received from many sources, not one is pure. It is grown as a kharif crop, occupying the land from June to October.

As regards its origin Watt (16) quoting Duthie says that it occurs wild in parts of the Himalayan region. De Candolle does not consider that it is truly wild anywhere and comes to the conclusion that the species existed before all cultivation, thousands of years ago in China, Japan and the Indian Archipelago.

For smut diseases see Jowar.

4. PENNISETUM, L. Rich.

A tall annual grass : *stems* solid, branching slightly ; upper *nodes* glabrous or woody, lower rooting : *leaves* lanceolate, spreading and drooping, more or less hairy ; *sheath* inflated ; *ligule* of hairs : *spike* cylindric, dense flowered ; *rachis* hairy or woolly, branchlets 1-8-flowered, concealed by the densely packed spikelets, which are in clusters of 1 to 3, surrounded by bristly involucels ; *spikelets* 1/7 to 1/5 inch, pedicelled ; *glume* I minute or absent, ½ orbicular ; *glume* II very variable in length, usually ⅙ to ½ IV, very rarely as long as IV ; *glume* III ovate oblong, obtuse and truncate and apiculate, 5-nerved, epaleate or paleate and male or neuter ; *glume* IV coriaceous or herbaceous, ovate acute, 5-7-nerved, *pale* very broad, truncate ciliate at the top and dorsally ; *anthers* linear ; *cells* with bearded tip : *grain* oblong, obovoid or pyriform, smooth, free and top exposed.

1. **Pennisetum glaucum,** R. Br. (*P. typhoideum*, Rich.) Bulrush Millet. **Vern.** Bajri. Sajgure (M) ; Bajri, Sejji (G) ; Bajhri (S) ; Bajra (H). Erect, 3 to 8 feet high : *stem* solid, simple or branched, often stout, leafy, upper joints smooth or woolly, lower rooting : *leaves* large, spreading and drooping, with a few bulbous hairs near the base ; *sheaths* moderately loose, closely furrowed smooth ; *ligule* of white, densely packed hairs : *stalks* of the inflorescence more or less woolly below the spike ; *spike* up to a foot long and 1½ inch broad, erect ; *axis* woolly ; *spikelets* in clusters of 1 to 8 on separate pedicels which are concealed within the continuously densely packed inflorescence ; *bristles* unilateral, varying in colour, inner ones plumose, all as long as the spikelets or some longer ; *glumes* I and II

minute ; *glumes* III and IV subequal with larger pales : *grain* obovoid, white, protruding from the glume and pale.

Pollination. Cross-pollination is the rule.

Var. 1. **Jabalpuri, Bhavnagri** or **Giant Bajri.** *Spikes* long and thick ; the gray purple *bristles* equalling or exceeding the spikelets.

Var. 2. **Malbandro** or **Medhodri.** Differing from Var. 1 in the thinner and shorter grey purple spikes and in the more membranous glumes.

Var. 3. **Nadiad Bajri** or **Deshi of Gujarat.** More vigorous in growth than Var. 1, but the spikes are thinner and shorter and are dull, light brown.

Var. 4. **Awned Bajri.** *Spikes* long and thick, one bristle on each pedicel is about ½ inch in length or twice the length of spikelet and pedicel.

Var. 5. **Deccan Bajri.** *Spike* short, thin and containing small seed.

Area. Bajri is a kharif crop. It occupies the lighter kinds of soils and tracts of low rainfall in all districts. In 1922-23 the crop occupied 4,018,089 acres or about 20 per cent. of the gross cropped area in the Presidency. It is the staple crop in a large tract. Ahmednagar claims 20·8 per cent. of the total area under Bajri, Nasik 16·6 per cent. and Poona 14·25 per cent. These districts are followed by Sholapur, Satara, West Khandesh, East Khandesh and Bijapur, each of which grows 7 to 8 per cent. of the total area. Ahmedabad claims 3·9 and Kaira 3·0 per cent.

The total area of Bajri in Sind was 771,367 acres in 1922-23. Out of which 500,000 are contributed by Thar and Parkar Districts and 150,000 by Hyderabad, Karachi, Larkana, Sukkur and Upper Sind Frontier Provinces contributing smaller areas.

5. ORYZA, L.

Annual, tufted, aquatic grass : *leaves* many, rather rough ; *sheaths* smooth : *panicle* elongate, erect at first, drooping as the grain ripens ; *spikelets* loosely arranged ; *glumes* 4, I and II minute, III and IV subequal without pales ; *glume* III often with a short or long awn ; *stamens* 6.

I. **Oryza sativa,** L. Rice. **Vern.** Terms applied to the grain : Bhat (M) ; Dangar (G) ; Bhatta, Akki (K) ; To the straw : Pendha (M) ; Paral (G) ; Bhattada Hullu (K) ; Saryun (S).

The following 15 varieties can be easily distinguished in the field and some contain many forms.

Var. 1. **Ambe Mohar.** *Heads* curved and drooping ; lower *branches* again drooping, upper approximate ; *spikelets* yellow brown at the tips ; *ears* distinctly exerted from the *flags* ; average number of primary *branches* in each head 10 ; empty *glumes* brown ; *spikelets* short, elliptic furrowed. **Vern. synonyms :** Ambemohar halva ; Halva Ambemohar ; Ambemohar Garva ; Ambemohar Tambadi ; Ambemohar Konkani garva ; Konkani halva.

Var. 2. **Kaud.** *Spikes* drooping; *primary branches* ascending; *spikelets* brown; *ridges* strong and yellow; *apiculus* produced into a minute awn; *spikelets* large; empty *glumes* brown: *grains* with a small nick on one side.

Var. 3. **Gudhya.** *Spikes* as in Var. 2; *spikelets* 3 together at the end of each branch; *ridges* strong and yellow; *empty glumes* brown: *grains* with a small nick on one side. **Vern. Synonyms :** Gudhia; semi-garva.

Var. 4. **Tulsia.** *Heads* strongly curved and drooping; *primary branches* below widely separated, strongly drooping, upper shorter, approximate; *flags* longer than the spikes; *spikelets* obovoid, furrowed and compressed; *empty glumes* light brown of the same colour as the awns; average number of *primary branches* 10.

Var. 5. **Rajawal.** *Spikelets* yellow, suffused with brown, with dark apiculus; *empty glumes* brown; *spikelets* narrow; *spikes* curved, colour of spikes resembling that or Ambemohar but deeper and the apiculus dark; *awns* long: *grains* long, narrow and hard.

Var. 6. **Bodka.** *Spikelets* obovoid, furrowed, inflated; *empty glumes* white; *ears* drooping; *primary branches* more or less approximate.

Varieties 1, 2, 3, 4, 5 have sweet-scented grains.

Varieties 2, 3, 4 and 6 have grains with a notch on one edge; grains broad and short.

Var. 7. **Kolamba.** *Heads* curved from the middle; *spikelets* yellow; a number of the lower *primary branches* have a tendency to rise upwards and forwards; *flag* rising above the ears; *spikelets* narrow, yellow with a very slight brown tinge; average number of *primary branches* 12; *empty glumes* paler than the others; *spikelets* linear oblong not furrowed. **Vern. synonyms :** Halva Mahadi; Barka Mahadia; Sonvel garva; Mahadia Warangal; Zina Kolamba; Barka Kolamba; Kamod-Jiri; Patni; Pandhara Kolamba.

Var. 8. **Velchi.** *Spikes* erect, rising out of the flag; *branches* approximate; *spikelets* reddish brown with distinct furrows, short and broad.

Var. 9. **Tamsal.** Resembling **Velchi** in colour but *awns* very long: *heads* drooping; number of *primary branches* 8, all separately drooping; *empty glumes* dull white; *spikelets* linear oblong, very slightly furrowed.

Var. 10. **Ghosalvel.** *Spikelets* long and broad; *flags* long; *branches* spreading drooping; *spikelets* and dull straw yellow; *empty glumes* white; average number of *primary branches* 9. **Vern. synonyms :** Tamsal, halva; Gosalvel; Gosalvel garva; Pandhrasal (Khadakwasla); Chimansal Dagni or Dangi.

Var. 11. **Kalisal.**

(*a*) *Spikes* exserted from the flag curved and drooping; *primary branches* long and separated, average number 9; *spikelets* ruddy black decidedly apiculate; *empty glumes* brown: *grains* long and narrow.

(*b*) *Flags* and *sheaths* ascending; *heads* curved and drooping; *lower branches* spreading and drooping, upper approximate; *empty*

glumes white ; average number of *primary branches* 10 ; *spikelets* pale black : *grains* broad. **Vern. Name :** Kachora garva.

(*c*) Same as (*b*), but *spikelets* smoky brown : *grains* long and broad. **Vern. name :** Nirpunji garva.

Var. 12. **Dodka.** *Spikelets* with dark bluish tips : *grains* broad : *ears* drooping and curved ; *primary branches* all more or less approximate ; *empty glumes* white ; *flags* longer than the spikes : average number of *primary branches* 8. **Vern. synonyms :** Malbhat halva, Garva Dodaka, Garvi Patni, Dodka, Kudhurti (Thana), Tuipakbi.

Var. 13. **Bhura.** *Spikes* thin, slightly curved and drooping ; *basal branches* when long drooping ; when short approximate as are the upper branches ; average number of primary branches 8. **Vern. synonyms :** Halvar halva, Bhadas, Halvi Patni, Dodka semi-garva, Patni (Thana), Torna (Thana), Bhura, Dodka (Khadakwasla).

Var. 14 **Hemdi** (Semi-garva). Resembling **Bhura** but *spikelets* suffused with brown ; *heads* curved and drooping on the upper third ; *lower branches* spreading and drooping rather widely separated ; upper shorter approximate ; *flag* exceeding the spike ; average number of *primary branches* 10. **Vern. synonyms :** Hemdi, Fada Kolamba, Khari Patni.

Var. 15. **Rata.** *Grain* red : spikelets 1-3 ; *spikes* erect ; *primary branches* sharply ascending ; *secondary branches* bearing 1-3 spikelets ; *spikelets* yellow suffused with chocolate brown in the distinct furrows. **Vern. synonyms :** Mahadi, Rata, Munda Rata.

All these classes have been arranged serially according to the quality of the grain and other affinities. Good varieties are always late in ripening.

A tentative botanical classification (after Mr. R. K. Bhide, formerly Crop Botanist) is as follows :—

A. White Grain types—

1. **Ambemohar.** *Grain* short rather thick for its length, partly opaque, fragrant, 75-80 grains per gram.

2. **Kolamba.** *Grain* slender linear elliptical, transluscent no smell, 85-90 per gram.

3. **Antersal** or **Mugad** type. *Grain* thick, coarse linear oblong, opaque, smell absent, heavy, 30-32 per gram.

4. **Bhadas** type. **Rangoon white.** *Grain* medium long, coarse, very opaque, no smell, 40 per gram.

5. **Kamode** type. Much like Kolamba. Little bit coarser than Kolamba, scented, longish, elliptical grains, 50-55 per gram.

6. **Patni.** *Grain* coarse, finer than Mugad type ; not scented coloured sheath.

B. Red grained types—

1. **Mhasad.** Muddy black ; *husk*, small *panicle*, early : *grain* red, very heavy, coarse short grain, 25 grains per gram.

The following strains have been evolved by breeding in this Presidency :—

Karjat strain No. 42 akin to **Ghudya Kolamba.** Its characters are : (1) Late rice—145 to 150 days, (2) high tillering and compact heads, (3) Milling quality—not cracking and taking a polish, and (4) market price only Rs. 5 per Khandi less than the finest **Kolamba.**

Karjat strain No. 35 akin to **Zina** type. Its characters are : (1) Yield 12 to 15 per cent. more than ordinary cultivator's type, (2) late rice 145 to 150 days and (3) finer than No. 42 and therefore better price.

Karjat strain No. 70 akin to **Kasadya.** Its characters are : (1) Early type, and (2) fetches better price than the ones which occupy early lands now.

Pollination. Normally self-pollination before the glumes open is the rule and is favoured by simultaneous maturing of essential organs. Cross-pollination may occur by wind or insect.

Area. In 1922-23 the total area under rice was 1,885,602 acres. It is chiefly cultivated in the Konkan and in the heavy rainfall strip of the Deccan called *Maval* or *Mallad* along and close to the Western Ghats. A fairly large area is also found in the districts of Gujarat. Thana, Kolaba, Ratnagiri and Kanara claim roughly 20, 15, 13 and 10 per cent. of the total area under the crop respectively, and Dharwar and Belgaum 9 and 6 per cent. respectively.

It is chiefly a kharif crop. In Kanara rabi rice is grown.

6. ZEA, L.

A tall stout annual monœcious grass : *leaves* broad, flat : *spikelets* unisexual ; *males* in terminal panicles ; *females* in axillary, thick spikes invested with sheaths ; *male spikelets* 2-flowered ; *glumes* 4, acute ; *glumes* I and II sub-equal ; *glumes* III and IV hyaline, paleate ; *stamens* 31 ; *female spikelets* 1-flowered, sessile, densely crowded in many vertical series on the thick cylindrical rachis ; *glumes* 4, membranous ; *glumes* I and II very broad, obtuse or emarginate ; *glume* III hyaline, paleate, empty ; *glume* IV hyaline, often 2-flowered ; *ovary* obliquely ovoid, plano-convex ; *style* very long, bifid ; *arms* papillose : *grain* large, sub-globose or flattened surrounded by the marcescent glumes.

Pollination. Cross-pollination is the rule.

1. Zea Mays, L. Maize. **Vern.** Makai, Bhuta (H) ; Maka (M) ; Makai (G) ; Goinjol, Mekkejola (K) ; Makai (S).

Mr. Mollison (12) says that two-thirds of the maize crop of the Presidency is grown in the Panch Mahals. It is also sparingly cultivated in Sholapur, Ahmednagar and Satara. Total area 2,089,914 acres.

7. SACCHARUM, L.

A tall perennial grass : *inflorescence* a large, cottony panicle ; *spikelets* minute, awnless, 1-flowered, binate a sessile bisexual and pedicelled female, rarely both pedicelled and bisexual ; *glumes* 4, all membranous,

or I strongly charataceous, or *glumes* I and II rarely coriaceous ; *glume* III empty ; *glume* IV shortest, rarely absent ; *pale* hyaline, nerveless or absent ; *lodicules* cuneate ; *stamens* 3 : *grains* oblong.

Saccharum officinarum, L. SUGARCANE. **Vern.** Us (M) ; Sherdi (G) ; Kabbu (K) ; Kamand (S). 8 to 10 feet high with thick solid juicy stems : *leaves* very long, 3 to 4 feet.

There are many varieties of cane grown of which the principal are as follows :—

A. Thick and juicy canes :

Pundya (pale yellow) group on the Deccan canals and in the Deccan districts. This occupies 75 per cent. of the total area.

Kabirya (stripe) in Sholapur, in the Valva taluka of the Satara District and in parts of Kanara.

Malbari (pale yellow) in the Surat district.

Kavangiri or **Kala Kalbari,** thick red cane, grows in Konkan and Nasik district.

B. Medium Thick canes less juicy than the above group.

Kavangiri or **Kala Malbari** (medium thick red cane) in the Konkan and in the Nasik district.

C. Thick and hard canes.

Kandya in the Western parts of Nasik and in the West Khandesh.

Wansi in the parts of the Mallad tract.

The area occupied by the medium and thin varieties is only relatively small.

Area. In 1922-23 the total area under sugarcane was 60,180 acres of which Poona claims 10,000 acres equal to Belgaum. Satara and Ahmednagar share 7,000 acres each and there are 4,500 acres in Nasik.

The yield of Gul from thin canes is about 3,500 to 4,500 pounds per acre. Thick varieties under well irrigation yield 5,000 to 7,000 pounds while under canal irrigation the yield reached up to 11,000 pounds per acre.

Diseases and Pests.

The Sugarcane borer eats the pith of the young shoots. The first sign of attack is drying up of the central leaf which is easily pulled out. The remedy is to plant setts of canes early, *i.e.*, in December.

Red Rot of Sugarcane. The upper leaves (the third or fourth leaf from the top) of a shoot begin to lose colour and droop slightly. There is withering at tips and margins leaving the centre green. Later on the whole crown withers and droops. In this way the tops of all the canes of a stool may be found withering gradually. If the affected canes are split open, the tissues at the lower points of the canes are found to be discoloured by reddened streaks and finally the whole of the cane may become reddened and die. In many instances, definite red blotches with a white centre transversely elongated are found in the internodes.

The reddening of the internal tissues extends right down into the stool which may soon die.

The best method of keeping down infection by the red rot fungus is to plant out setts that come from a healthy stock. All setts intended for planting out which show reddening at the cut ends must be discarded. The practice of ratooning in infected fields should never be encouraged, as it not only helps the fungus to establish itself more firmly in the stool, resulting in a diseased condition of the new growth, but the exposed cut surfaces offer a very convenient means of secondary infection by spores formed on ratoon canes lying about in the field. Excessive flooding and the growth of cane in water-logged soil may also be mentioned as factors predisposing the plant to disease. (See leaflet No. 7 of 1928.)

* 8. ANDROPOGON, L.

A tall annual grass : *stems* robust, solid : *leaves* large and broad, smooth except near the base ; *midrib* broad ; *margins* rough and cutting : *panicles* congested or open, erect when young, often nodding before the ripening of the grains ; *branches* and *branchlets* in whorls ; *spikelets* in pairs, each 1-flowered, the lower sessile, hermaphrodite, the upper pedicelled hale ; *glumes* usually protruding.

1. **Andropogon sorghum,** Brot. GREAT MILLET. **Vern.** Jowar, Jowari (H, M, G) ; Jola (K) ; Jawar (S). Height from 3 to 15 feet, according to variety and character of season : *stems* thin or thick : *leaves* alternating broad ; *sheath* terete ; *ligule* rounded : *panicle* from 6 inches to 2 feet long, congested so as to form an almost solid ovoid or ellisoid head in the more typical forms ; *sessile spikelets* with *glume* I 5-11-nerved above, *glume* II chartaceous with ciliolate margins, *glume* III shorter, elliptic oblong, hyaline, 2-nerved, *glume* IV smaller, ovate obtuse, entire or bifid, awned or not, *awn* short, when present, *pale* linear oblong, ciliate ; *pedicelled spikelet* with *glume* I glabrous, 5-9 nerved ; *glume* II lanceolate, 3-5 nerved ; *glumes* III and IV if present, hyaline.

Classification.

Subspecies A. *Heads* ovoid, congested ; *branches* very short, crowded ; peduncle usually strongly recurved.

Series 1. Tall robust plants : *heads* large and long.

Variety 1. *Grains* yellow. **Vern. names :** Jvala ; Jvari ; Muntingal ; Nandial (Surat Farm).

Variety 2. *Glumes* light brown : *grains* greenish. **Vern. name :** Karjowar (Surat Farm).

Variety 3. *Glumes* dark brown : *grains* yellowish brown. **Vern. name :** Akada E. (Surat Farm).

* The generic name Andropogon is retained for the sake of convenience, although it is more appropriate to use the name Holcus, to which the forms described here have been assigned by Linnæus. Since Linnæus' Species Plantarum (1753) has been accepted by the Brussel's Botanical Congress (1910) as the starting point in botanical nomenclature for flowering plants, the question of the use of the name Sorghum, which was used in pre-Linnæan times and was taken up by some post-Linnæan botanists, does no more arise.

Variety 4. *Glumes* dark brown : *grains* white. **Vern. names :** Akada A. Dukari (Nasik District) Dhaola or Garia-kalgondi (Surat Farm).

Variety 5. *Glumes* reddish : *grains* greenish. **Vern. names :** Adola (Surat Farm) ; Chapti (Poona farm) ; Chapti (Surat Farm) ; Desi Perio (Surat district) ; Dukri (Surat Farm) ; Dukaria (Poona Farm) ; Falgai Karhagi (Surat Farm) ; Gari (Khandesh District). Gunda A. (Poona Farm) ; Gund (Belgaum District) ; Garia (Surat Farm) ; Jowari Ganeo (Manjri Farm) ; Kalyar (Dharwar District) ; Lohu (Dharwar District) ; Mannarpuri Gidd (Belgaum District) ; Mungar (Bijapur District) ; Nilva (Manjri Farm) ; Nilva (Ahmednagar) ; Perio (Poona Farm) ; Shalu (Bijapur District) ; Sampgaon No. 2. (Surat Farm) ; Shedga (Belgaum District) ; Udda Maldandi (Belgaum District) ; Yangar (Dharwar District).

Variety 6. *Glumes* reddish brown : *grains* dull white. **Vern. name :** Ratada (Panch Mahals).

Variety 7. *Glumes* brown : *grains* almost orange red. **Vern. names :** Bilgi (Bijapur District) ; Rati (Poona Farm).

Variety 8. *Glumes* black : *grains* red. **Vern. names :** Kempu B. (Poona Farm) ; Nilva (Poona Farm) ; Sakarmakar (Poona Farm).

Variety 9. *Glumes* greyish brown : *grains* red.

Series 2. Plants not so robust : *heads* usually shorter and narrower.

Variety 1. *Glumes* greyish red : *grains* dull white. **Vern. names :** Jogadi (Poona Farm) ; Tambadi (Sholapur).

Variety 2. *Glumes* greyish red : *grains* greenish **Vern. names :** Akada (Surat Farm) ; Chumasa Jowar (Broach) ; Dukeri B. (Poona Farm) ; Dukar makshi (Ahmednagar) ; Dagadi (Nasik) ; Gadadi (Sholapur) ; Gare (Nasik) ; Guldhadi (Ahmednagar) ; Gola (Ahmednagar) ; Gangri (Surat) ; Hundi (Bijapur District) ; Hundi (Satara District) ; Kalbondi (Ahmednagar) ; Lakadi Gowar (Nasik) ; Malo (Surat District) ; Maldandi (Sholapur) ; Malvan (Ahmedabad) ; Nandivan (Dharwar) ; Shalu (Nasik) ; Shalu (Satara).

Variety 3. *Glumes* grey : *grains* white, double (each spikelet produces two grains). **Vern. names :** Dudhia (Kaira District) ; Khondi (Nasik) ; Kunbi (Poona District) ; Utavli (Ahmednagar) ; Venoti Gundi (Belgaum District).

Subspecies B. *Heads* cylindrical ; *branches* ascending, a little larger and not so congested as in Subspecies A ; *peduncles*, as a rule, never more than slightly curved.

Variety 1. *Glumes* reddish brown : *grains* white spotted with red. **Vern. name :** Sholapuri (Cawnpur Farm).

Variety 2. *Glumes* grey : *grains* white, only slightly spotted with red. **Vern. names :** Akada (Surat farm) ; Chikna (Poona Farm) ; Guidhaga (Surat farm) ; Jowar (Panch Mahals) ; Jagada (Sholapur District) ; Maldandi (Poona Farm) ; Nialo (Poona Farm) ; Sholapuri (Surat District) ; Sargad (Poona Farm).

Variety 3. *Glumes* reddish : *grains* white. **Vern. names :** Akhada Khandesh (Surat Farm) ; Basavan pad (Belgaum District) ; Biinandial (Belgaum District) ; Dukri (Satara District) ; Garia yellow (Surat Farm) ; Gid Jowari (Poona Farm) ; Gid Maldandi (Belgaum District) ; Gidgempu (Surat Farm) ; Gid Gap (Satara District) ; Gund Chikodi A. (Poona Farm) ; Kala Gund (Belgaum District) ; Khabbu Shedgar (Belgaum District) ; Kaliagondicha vilaiti (Belgaum District) ; Maldandi (Belgaum District) ; Mad Shedgar (Belgaum District) ; Margea (Poona Farm) ; Perio halke (Surat District).

Variety 4. *Glumes* and *grains* reddish brown. **Vern. name :** Hulgi Jola (Poona Farm).

Variety 5. *Glumes* black and longer : *grains* dull white.

Variety 6. Glumes shorter than the *grains*. **Vern. name :** Kagi Moti (Bijapur District).

Variety 7. *Glumes* red, tipped with black. **Vern. name :** Argad (Satara District).

Variety 8. *Glumes* yellowish white : *grains* pure white. **Vern. name :** Parmsala (Belgaum District).

Subspecies C. Usually robust plants : *peduncles* straight or curved ; *heads* large, thick forming a thyrse, all the branches either ascending or the central longer and drooping.

Variety 1. *Glumes* reddish grey : *grains* white, scarcely larger than the glumes. **Vern. names :** Gavati (Surat Farm) ; Elichpuri (Surat Farm) ; Elichpuri (Khandesh District) ; Kar Jowar A. (Surat Farm).

Variety 2. *Grains* white, longer than in **Variety** 1. **Vern. names :** Elichpuri (Surat Farm) ; Gari (Poona) ; Gari (Surat Farm) ; Jowar (Nandgaon, Nasik District) ; Kach Kachi (Poona Farm) ; Patasi (Surat Farm).

Variety 3. *Glumes* reddish brown, as long as the white *grains*. **Vern. names :** Gund Chikodi (Poona Farm) ; Nirmali (Surat Farm) ; Nirmali (Khandesh District).

Variety 4. *Glumes* almost black : *grains* greenish. **Vern. names :** Akada C. (Surat Farm) ; Dudha Mogra (Poona Farm).

Variety 5. *Glumes* and *grains* brownish red. **Vern. names :** Dhavera (Poona Farm).

Variety 6. *Glumes* reddish brown : *grains* brownish white. **Vern. names :** Bendi (Ahmednagar District) ; Dhavan (Poona Farm) ; Makchandri (Bijapur District).

Variety 7. *Glumes* reddish : *grains* white, tinged strongly with red. **Vern. name :** Margar B. (Surat Farm).

Subspecies D. *Inflorescence* as in **subspecies C.** but *glumes* larger elongate, pointed, light, yellow tinged with red : *grains* dull white. **Vern. name :** Rajhane (Poona Farm).

Subspecies E. *Inflorescence* a loose, pyramidal pancile ; *branches* regularly radiating, becoming shorter upwards.

Variety 1. *Glumes* and *grains* white tinged with red. **Vern. names :** Farfaria (Kaira District) ; Lagva (Nasik District) ; Sundia (Panch Mahals) ; Sundia B. (Poona Farm).

Subspecies F. *Panicles* oblong ; *spikelets* loosely arranged, drooping, more or less subequal in length ; *glumes* black, shining, as long as the reddish *grain*. Sorghum Collier. Sorghum Amber. **Vern. name :** Impi (Poona Farm).

Subspecies G. *Spikes* long, forming a curved drooping or secund panicle ; *glumes* ovate acute, a little longer than the white *grains*. **Vern. names :** Moti Jhondala (Belgaum District) ; Moti Char (Poona Farm) ; Jhanki (Bijapur District).

The distribution of this crop is regulated by the character of the soil as well as by the average rainfall. When the rainfall is excessive it gives place to rice. On the sandy soils of Gujarat and the thin soils of the Deccan it gives place to Bajri. Elsewhere in the Presidency, except perhaps in the Panch Mahals, where maize is the staple, and in certain localities favourable for wheat, it is the most important food-grain crop. In the Konkan on account of the heavy rainfall, it occupies a very small area.

Kottur (11) has also classified the local varieties of jowars of the Bombay Karnatak into 2 main divisions with 7 sub-divisions which in all include 112 local types. He relies on three constant characters principally in the classification which are :—(*a*) the character of the ear —the length of the rachis and its mode of branching give the ear a definite shape which can be easily identified, (*b*) the character of the grain—the size, shape and colour of the grain when not discoloured by late rains, and (*c*) the character of the glumes—the colour and hairiness when colour is not confused by slight shades.

Division I. *Rachis* long ; *glumes* partly covering the grain : *internodes* long : *grain* oval, flat or yellow, white or red.

Group 1. *Ear* very open ; *branches* long and hanging : *grains* few. **Vern. name :** Chowri.

Group 2. *Ear* long and thin ; *branches* erect, almost parallel to the rachis : *grains* oval flat, white yellow or red. **Vern. names :** Hundi, sadagar, Karjola.

Group 3. *Ear* long and thick; *branches* long at an angle to the rachis. **Vern names :** Kanjola ; Gidgempu ; Huchpir, Halmukka.

Division II. *Rachis* long; *glumes* completely covering the grain.

Group 4. *Ear* long and thin; *branches* erect: *grains* big or small, oval: *flower* yellow or red or white. **Vern. name :** Ambemohar.

Group 5. *Ear* long and thick; *branches* spreading. **Vern. name :** Kanmuchgan.

Division III. *Rachis* short; *glume* partly covering the grain; *ear* elliptical or ovate.

Group 6. Branches crowded; *internodes* more or less distinct: *ear* loose. **Vern. names :** Bile Fulgar; Basavan pad.

Group 7. *Branches* congested; *internodes* absent: *ear* compact. **Vern. names :** Dagdi ; Handi musadi ; Bili Jola ; Yennigar ; Kempu Jola.

Pollination. Cross-pollination between flowers of the same inflorescence is the rule, the pollen from the higher and earlier opening flowers falling on the stigmas of lower and later flowers. Cross-pollination by foreign pollen can take place in the first flowers to open (*i.e.*, the ones at the tip) and possibly in the case of late opening flowers whose anthers fail to dehisce. Self-pollination may take place in late opening flowers whose stigmas are surrounded by anthers but here cross-pollination by upper flowers is more possible.

Though jowar is anemophilous (wind-pollinated), bees may bring about cross-pollination.

Cross-pollination takes place more in loose inflorescence than in compact ones and more in flowers with short glumes than in those with long glumes.

Parasites. The jowar crop in the field is frequently infected with a phaneorgamic parasite known as *Striga lutea*. **Vern.** Tahuli (M) ; Bile Kasa (K). The roots of the parasite come in contact with those of the jowar and develop swollen tissue (*Haustorium*) through which elaborated sap of the host is sucked by the parasite.

The *Strigas* are small plants about 6-12 inches high, with 2-lipped yellow or white or pink corolla and 4 stamens. The distinction between the species lies in the ribes of the calyx.

The remedy is to grow a trap crop and pull out the trap crop and parasites before the production of seed.

Smuts. There are four distinct smuts that occur on jowar.

1. Grain Smut. Here the normal grains in the head are transformed into enlarged, elongated, conical bodies protected for some time by a greyish membrane which on rupture exposes a dusty mass of black spores.

2. Loose Smut. This differs from the above in that the affected body has a fragile membrane which ruptures even before the head comes out. On exposure the head presents a dark sooty appearance.

3. Long Smut. Here the affected individual grains are much more elongated than either of the above two, up to as much as 1½ inches in length.

4. Whole-head Smut. Here instead of individual grains being involved, the whole of the head, including the rachis, is converted into a fibrous spore mass.

Area. In 1922-23, of the total area of 8,236,915 acres nearly two-thirds is grown in the Rabi season and the rest in the kharif season. Sholapur, Bijapur and East Khandesh claim about three-quarters of the rabi area. Poona, Satara and Dharwar also return a large area of rabi jowar, Dharwar, Bijapur and East Khandesh claim half of the total kharif area, while Belgaum, Ahmedabad, Satara and Poona grow very large quantities of kharif jowar.

There are over a hundred varieties of jowar. The best known ones are **Sathe, Peerio, Chapti, Sholapuri, Aispuri, Garya, Gidhagi, Bedri, Dagadi, Maldandi, Dukri, Gidgap, Argad, Utavli, Nilwa** and **Sundhia. Sundhia** is the best fodder variety of Gujarat and **Nilwa** is the best fodder variety of the Deccan for a monsoon crop and **Utavli** is another good Deccan variety suitable for later sowing.

9. AVENA, L.

Annual grass, tufted : *spikelets* in effuse panicles, pendulous ; *glumes* dorsally rounded ; *glumes* I and II empty, subequal, persistent, 5-7-nerved ; *flowering glumes* ovate or lanceolate, 2-toothed or cleft ; *awn* dorsal, below the cleft ; *pale* narrow ; *ovary* with a villous top : *grain* adhering to pale.

1. **Avena sativa,** L. Oats. **Vern.** Jai. *Stems* tufted 2 to 3½ feet high : *spikelets* smooth, large, pendulous, each with 2 or more perfect flowers ; *flowering glumes* awned on the back : *grain* furrowed in front, adhering to pale.

This is a rabi crop grown sparingly in Poona, Ahmednagar, Satara and Ahmedabad.

10. ELEUSINE, Gaertn.

Annual tufted grass : *spikelets* 3-5-flowered, sessile, secund, forming a digitate spike. laterally compressed ; *glume* I lanceolate ; *glume* II lanceolate ; *flowering glumes* similar but larger, 3-nerved ; *pales* complicate, strongly keeled on the back : *grain* free, with a thin loose pericarp ; *seed* rugose.

1. **Eleusine indica,** Gaertn., cult. form. **Coracana,** Gaertn. **Vern.** Nagli or Nachni (M) ; Bavto or Nagli (G) ; Ragi (K) ; Nangli (S). Annual, smooth : *stems* tufted, stout, erect, compressed, 2 to 4 feet high : *leaves* 2-ranked, broad, mouth of sheath bearded : *inflorescence* a cluster of 4 to 6 often strongly incurved spikes ; *spikelets* in 2 rows, 3-6-flowered, closely arranged on the upper side of the rachis : *grain* small, brown, enclosed in a membrane.

Mr. Mollison (12) says that many varieties exist. They are comprehensively grouped in the Konkan and Ghat districts of the Presidency

as early (**halvi**) and late (**garvi**), the former ripening in late September or early October, and the latter in late October or November ; that the grain occupies the 5th place among the Bombay cereals. In the Kaira and Ahmedabad Districts of Gujarat and in the adjoining Baroda Territory heavy crops are produced. Elsewhere in the Presidency the cultivation is chiefly confined to the poor uplands of the Ghâts.

It is entirely a kharif crop in this Presidency.

11. TRITICUM, I.

Wheat **Vern.** Gahu (M) ; Gahu (G) ; Godhi (K) ; Kanik (S). Tufted, annual grasses ; *culms* tufted : *sheaths* striate ; *ligule* a lacerated membranous ring ; *leaves* glabrous or hairy on one or both surfaces : *spike* glabrous or hairy, awned or awnless ; spikelets 2 ranked, compressed, parallel to the rachis, closely or loosely imbricate ; *glume* I keeled upwards ; *glume* II sometimes paleate ; *glumes* III and IV paleate and hermaphrodite, larger than V and succeeding glumes when present ; *stamens* 3 ; *stigmas* short and never protruded ; *ovary* truncate and hairy on top : *grains* in each spikelet, usually 3, the 2 lateral larger than the single terminal one (in examples when there are 4 grains in a spikelet the 2 lower ones are invariably larger than the upper 2), in shape they are oblong, swollen more or less according to the quality, with a groove on one face, blunt at both ends (excepting **Khapli**) surrounded by a hairy tuft.

1. **Triticum æstivum,** L.

Spikes rather long, either altogether beardless or with very short awns	Var. 1.	**Beardless Wheat.**
Spikes small and short, densely packed with smooth round spikelets	Var. 2.	**Junaria Wheat.**
Spikes dense, smooth ; *awns* very long, spreading in the ripe heads ..	Var. 3.	**Popatia Wheats.**
Spikes loosely arranged and awns much shorter	Var. 4.	**Daud Khani Wheats.**
Covered grain wheat	Var. 5.	**Khapli** or var. **Spelta.**

2. **Triticum pilosum,** Dalz. and Gibs.

Spikes velvety, long awned	Var.	**Kala Kushal or Bakshi.**

1. **Triticum æstivum,** L. (*T. hybernum,* L.)

Var. 1. **Beardless Wheat.** Height up to $4\frac{1}{2}$ feet : *sheaths* smooth, striate and puncate ; *leaves* 12 to 15 inches long, by $\frac{1}{2}$ to $\frac{3}{4}$ inch broad, scabrous above, smooth below : *spikes* (excluding awns) $2\frac{1}{2}$ to 6 inches

long, average number of spikelets in each spike 16 to 20, their surfaces glaucous, smooth or most minutely hairy ; *awns* extremely short ; *glume* I only strongly keeled upwards ; *glumes* II and III smaller to I, the latter hermaphrodite and paleate ; *glume* IV similar to III ; *glume* V also similar to III but smaller ; *glume* VI also similar but smaller still ; *glume* VII very small, paleate, empty ; *glume* VIII minute, imperfect (VII and VIII are often absent) : *grain* hard white.

Spikes smooth or nearly so. **Vern.** Pivla Potia (Nasik District) ; Pivla lotaka (Nasik District).

Var. 2. **Junaria Wheat.** Height $2\frac{1}{2}$ to $3\frac{1}{2}$ feet ; *culms* stout and rather succulent ; *nodes* thinly hairy ; *sheaths* rather loose, conspicuously white striate and punctate ; *leaves* ascending, not drooping at the tips, 4 to $8\frac{1}{2}$ inches long, $\frac{3}{8}$ to $\frac{1}{2}$ inch broad, strongly scabrid above, faintly so beneath : *spikes* 2 to 3 inches long ; *awns* almost absent or moderately long ; *rachis* flexuous ; *spikelets* closely packed, $\frac{3}{8}$ by $\frac{3}{8}$ inch, surfaces smooth ; *keels* scabridly ciliolate ; *glume* I white, broadly ovate, apiculate ; *nerves* indistinct except at the apex ; *glumes* II equal to I ; *glume* III equal to I, but never rounded and membranous, paleate, hermaphrodite ; *glum* IV as in III ; *glume* V as in IV but distinctly smaller ; *glume* VI minute, empty, pressed closely against V : *grains* hard white, very broad in comparison with their length.

Seen only from the Ahmednagar District.

Var. 3. **Popatia Wheats.** Average height about 4 feet : *sheaths* minutely hairy, longitudinally striate ; *leaves* 12 to 17 inches long by $\frac{1}{2}$ to $\frac{3}{4}$ inch broad, scabrous, thinly pilose on the upper surface, minutely puberulous beneath ; *margin* slightly cutting : average length of *spikes*, including awns, 6 to 9 inches, excluding awns, 3 to 4 inches ; *average* number of *spikelets* in each spike, 12 to 18, their surface green, with a waxy bloom, becoming suffused with a purple tint when half ripe, of a pale straw colour when fully ripe, glabrous, excepting the keels and margins of the glumes which are scabridly ciliolate ; *glumes* I and II equal, obtusely and falcately mucronate ; *glume* III equal to I and II, pale large, awn long ; *glume* IV equal to III ; *glume* V small and thinner and III and IV, *awn* very short ; *glume* VI similar to but smaller than V, also hermaphrodite ; *glume* VII very small, empty : *grains* hard yellow and hard red.

With hard yellow grains : **Vern.** Hansia (Broach) ; Lashkari (Ahmednagar) ; Pivla (Nasik) ; Shet (Ahmednagar) ; Sudhi (Ahmednagar).

With hard red grains. **Vern.** Deshi (Belgaum) ; Katha (Baroda) ; Lal Bakshi (Nasik) ; Malaia (Belgaum) ; Popatia (Kaira) ; Pel (Khandesh). Cultivated in Gujarat, Deccan and Karnatak.

Var. 4. **Daudkhane Wheats.** Height 4 feet : *sheaths* striate, glabrous ; *leaves* more or less hairy, scabrid above, almost smooth, below 8 to 11 inches long, by $\frac{1}{4}$ to $\frac{5}{8}$ inch broad, margins slightly cutting : *spikes* including awns, 5 to 8 inches long, excluding awns, $2\frac{1}{2}$ to $4\frac{1}{2}$ inches ; average number of *spikelets* in each spike 14 to 20, their surfaces smooth, keels slightly ciliate ; *glume* I tough, few nerved, shortly awned or awnless,

glume II equal to I ; *glume* III equal to I and II but more membranous, rounded, long awned, paleate ; *glume* IV equal to III ; *glume* V smaller, hermaphrodite, very shortly awned ; *glume* VI minute empty : *grain*, hard red.

With hard red grains. **Vern.** Poptia (Nadiad, Kaira).

Seen only from the Kaira District in Gujarat.

Var. 5. **Khapli** or var. **spelta,** Bailey (*T. spelta*, L.). Height 3½ feet : *sheaths* smooth, striate ; *leaves* 8 to 13½ inches long, by ¼ to ⅝ inch broad, scabrous on upper surface, almost smooth beneath, *margins* slightly cutting : length of *spikes*, including awns, 5½ to 8 inches, excluding awns, 1¾ to 3 inches ; average number of *spikelets* on spikes about 20, their surfaces quite smooth ; *glume* I obtuse, almost bony, *nerves* distinct, *keels* strong, *margins* scabrous ; *glume* II equal to I ; *glume* III larger than I and II, comparatively membranous, *awn* long *pale* not folded strongly ; *glume* IV as III ; *glume* V small, imperfect : *grain* red, pointed within the closely adherent glume and pale.

Grains hard red. Spelt. **Vern.** Khapli (M) ; Jod (S).

2. **Triticum pilosum,** Dalz. and Gibs. Height 3½ to 4½ feet : *nodes* thinly and minutely strigulose, with a glaucous bloom ; sheaths glabrous, glaucous, longitudinally striate ; *leaves* 10 to 18½ inches long, ½ to ¾ inch wide ; *blade* linear lanceolate, acuminate, flaccidly coriaceous, both surfaces dull green, smooth, margins not cutting : surface of *spikes* densely white, pilose glaucous with a powdery bloom ; length of *spikes* (excluding awns) 2½ to 3½ inches, with awns, 6 to 8½ inches ; *spikelets* on each spike vary in number from 8 to 22, their average length and breadth (excluding awns) ⅝ by ⅜ inch ; *glumes* I and II equal ; *glumes* III equal to I and II, awn long, *pale* large, membranous, 2-keeled, keels ciliate ; *flower* hermaphrodite ; *glume* IV and its enclosed pale and flower altogether similar to III ; *glume* V and its pale distinctly smaller, also hermaphrodite, *awn* very short or occasionally as long as in III and IV ; *glume* VI terminal, epaleate, very small, neuter (in some spikelets a *glume* VII is present, which is minute and neuter, and VI is small, but paleate, hermaphrodite and fertile) : *grains* hard white, yellow or red.

With hard white or yellow grain : **Vern.** Bakshi (Nasik) ; Bakshi (Ahmednagar) ; Kala Kushal (Ahmednagar) ; Kate (Ahmednagar) ; Kala Kushal (Poona, Nasik, Khandesh) ; Pivla Bakshi (Nasik) ; Pivla Gahu (Nasik) ; Pan (Sangli) ; Sudhe (Ahmednagar).

With hard red grains. **Vern.** names :. White and black awned (Belgaum) ; Katha (Nasik and Khandesh).

A rabi crop of the Deccan.

Pollination. Wheats are usually self-pollinated. Cross-pollination in the field is possible because (1) glumes remain open for 15 minutes, (2) anthers project out and throw pollen which is easily carried by wind, and (3) emasculated flowers are known to set seed.

Area. The total area under wheat in 1922-23 was 1,526,344 acres. Nasik stands at the head of the districts in the Bombay Presidency as

wheat producers containing 17·6 per cent. of the total wheat area followed closely by Dharwar which has 17·3 per cent. After this comes Ahmedabad with 10·7 per cent., West Khandesh 9·5 per cent., Ahmednagar 8·2 per cent. and Belgaum 6·5 per cent. in that order.

Kata or **Shetgahu, Wagia, Daudkhani, Bakshi, Mundi, Potya** and **Khapli** are the principal varieties grown. **Khapli** and **Bakshi** (Kala Kusal) are irrigated wheats and the others are dry crops. The normal outturn of wheat in the Presidency is 575 lbs. of grain and about 1000 lbs. of fodder.

The total area under wheat in Sind in 1922-23 was 405,401 acres and out of which Larkhana and Upper Sind Frontier Districts contribute one-fourth area each and Thar and Parkar 70,000 acres and Sukkur 77,000 acres. In the remaining districts the area is smaller.

Diseases. Rusts. There are three rusts attacking the wheat crops of the Presidency and causing considerable reduction in yield.

1. Black Stem Rust. In the early stage pustules of brownish tinge are most common on the stems and leaf sheaths and very rarely on leaf blades of the plants. Later on black pustules of a later phase of the life of the fungus appear on the stems and leaf sheaths and constitute the most conspicuous symptom.

2. Orange Leaf Rust. The most conspicuous feature of this rust is the abundant bright orange coloured pustules on the leaves, grouped in small clusters or irregularly scattered on the leaves, being scarce on sheaths and stalks. At a later stage it is difficult to distinguish by colour the pustules of this rust from those of any other rust.

3. Yellow or stripe Rust. The pustules on mature host plants are grouped in stripes lengthwise of the leaf or stem. On younger plants the stripe characteristic is not pronounced, the yellow pustules being scattered evenly over the surface.

The only method of control of these rusts is to breed rust resistant varieties of wheat to suit a tract and introduce them into general cultivation. Pusa No. 4 and Pusa No. 12 are two rust resistant varieties available in India. They have been found partially rust resistant in this Presidency.

12. HORDEUM, L.

Annual, tufted, smooth : *sheaths* smooth : *spikelets* one-flowered, in pairs or threes in notches or joints of a simple cylindrical spike, with which they are parallel, oblong, compressed ; *glumes* I and II rigid, very narrow ; *glume* III dorsally rounded, 5-nerved above, narrowed into an erect or recurved awn, *pale* 2-keeled ; *stamens* 3 ; *style* very short : *grain* grooved on the inner face, tip usually hairy, free or adherent to the pale.

1. **Hordeum vulgare,** L. Bailey, **Vern.** Satu (M) ; Jave godhi (K) ; Jawa (S).

Spikelets 6-ranked	.. Var. hexastichon.
Spikelets 2-ranked	.. Var. distichon.

Var. **hexastichon.** Barley (Kotri, Ahmedabad). **Vern.** Java satu; Kushali Satu; Sadhe satu (Satara). Height 2½ feet: *roots* woolly as in wheats: *culms* membranous, tufted, stout, succulent; *nodes* waxy: concealed within the leaf sheaths, which are smooth, loose, striate, *ligule* membranous; *base* of *leaf* distinctly auricled; *auricles* subspirally lanceolate acuminate; *leaves* sharply ascending, linear lanceolate acuminate on both surfaces; *midrib* distinct, white; *blades* 9 to 12 inches long, ½ to ⅝ inch broad: *spike* emerging from the inflated sheath of the flag; length with *awns* 6 to 8 inches, without awns, 2¼ to 3¾ inches; *spikelets* 10 in each of the 6 ranks; glume 8, ½ inch long, subulate, slightly awned, white hairy on base; *glume* II similar but *awn* ½ inch long; *glume* III glabrous, bony, white, transparent, with 5 strong nerves which are slightly ciliate on the back; margins strongly incurved, *awn* long, flattened, pale oblong, truncate, *nerves* 2, strong, green, not keeled, the glume and pale tightly enclosing the seed; *lodicules* obovate, long ciliate above; *ovary* cuneately obovoid, top densely hairy; *stigmas* short, white, plumose, included; *stamens* 3, *anthers* white short.

Var. **distichon.** Height about 3 feet: *leaves* scabrid on both surfaces, 6 to 10 inches long, by ¼ to ½ inch broad: *spikes* emerging from leaf sheaths, 2-ranked, length with awns 7 to 8 inches, without awns 3 to 3½ inches; *spikelets* in each row 10 to 15, 2 rows of barren spikelets alternating with each row of fertile, surfaces smooth; *barren spikelets* with *glumes* I and II, slender, awned, about ½ inch long, slightly exceeding III, which is linear oblong, rounded at apex, ciliolate, 5-nerved, *pale* slightly smaller; *glume* IV rudimentary; *fertile spikelets* with *glumes* I and II subulate, awned 1-nerved; *glume* III 5-nerved, *pale* 2-nerved both closely embracing the grain.

Barley is not extensively grown in Bombay. It is cultivated as a rabi crop in Sind, Ahmedabad, Kaira, Panch Mahals, Satara, Sholapur, Poona and Ahmednagar.

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GLOSSARY

Accrescent : increasing in size with age.

Accumbent : lying against another body.

Achene : a small, hard, dry, indehiscent fruit, strictly of one carpel.

Acuminate : having a gradually diminishing point.

Acute : distinctly and sharply pointed but not drawn out.

Adnate : attached the whole length.

Adventitious buds : those produced from stem instead of the axil.

Adventitious Roots : those produced from any other part except from the radicle.

Aggregated : collected together.

Albumen : the nutritive material stored in the seed and in many cases surrounding the embryo.

Amygdaloid : almond shaped.

Amplexicaul : stem clasping.

Androecium : the stamens collectively ; the male system of the flower.

Andromonoecious : having perfect and male flowers but no female flowers.

Annulate : ring shaped.

Anther : that portion of a stamen which contains pollen.

Apiculate : furnished with a sharp and short, but not stiff point.

Appressed : lying flat for the whole length of the organ.

Areolate : marked out with distinct shallow spaces on a surface.

Aril : an expansion of the funicle, arising from placenta, and enveloping the seed.

Auricle : a small lobe or ear, an appendage to the leaf.

Auricled : having an auricle.

Axil : the angle formed between the axis and any organ which arises from it, especially of a leaf.

Axile : belonging to the axis.

Awn : a bristle like appendage occurring on the glumes of grasses.

Berry : a succulent fruit with hard seeds embedded in pulp.

Biflorous : two flowered.

Bilabiate : two-lipped.

Bipinnatisect : when both primary and secondary divisions of a leaf are pinnate.

Biseriate : in two series or rows.

Blade : the flat portion of a leaf.

Boll : fruit of the cotton plant.

Bract : the modified leaf intermediate between the calyx and normal leaf, subtending a flower or a flower stalk.

Bracteate : having a bract.

Bracteole : a small bract.

Bulb : a modified bud, usually underground.

Bulbil : a small bulb, usually axillary.

Caducous : drooping off early.

Callosities : hard thickenings of part of an organ.

Calyx : the outermost of the floral envelopes.

Campanulate : bell-shaped.

Canaliculate : channelled with a longitudinal groove.

Capitate : pin headed ; having a head.

Capsule : a dry dehiscent fruit.

Carpel : a simple pistil.

Cartilagenous : hard and tough.

Catkin : a deciduous spike, consisting of unisexual apetalous flowers.

Caudatus : tailed.

Cauline : belonging to or growing on stem.

Ciliate : fringed with hairs.

Circumscissile : cut round.

Claw : the narrowed base of the petals.

Clawed : having a claw or claw like.

Cocci : plural of coccus.

Coccus : part of a schizocarp or lobed fruit.

Columnar : having the form of a column.

Coma : the hairs at the end of some seeds.

Commissure : the face by which two carpels adhere.

Commissural : adjective from commissure.

Compound : similar parts aggregated into a common whole.

Conduplicate : folded together length wise.

Connate : united.

Connective : the portion of a stamen distinct from the filament which connects the two lobes of an anther.

Connivent : coming into contact or converging.

Constricted : drawn together or contracted.

Contorted : twisted.

Convolute : when one part is wholly rolled up in another.

Cordate : heart shaped, applied to leaves having the petiole at the border and notched end.

Coriaceous : leathery.

Corolla : the interior perianth, composed of petals.

Corymb : a flat topped or merely convex and open flower cluster of the intermediate or the centrepetal order.

Corymbose : arranged in corymbs.

Cotyledons : the seed lobes, the first leaves of the embryo.

Crenulate : crenate but toothing themselves smaller.

Crest : an out growth of the funiculus in seeds ; a ridge on summit of an organ.

Cruciform : cross shaped.

Crustaceous : of brittle texture.

Cyme : a flower cluster of centrifugal type especially broad and flattened one.

Cymose : bearing cymes.

Deciduous : falling in season.

Decompound : several times divided.

Declinate : bent or curved downwards or forward.

Decurrent : running down, as when leaves are prolonged beyond insertion and thus run down stem.

Deflexed : bent outwards.

Dehiscence : mode of opening of fruit or anthers.

Dehiscent : splitting.

Dentate : toothed.

Diadelphous : with two groups of stamens.

Dimidiately : halved as when half an organ is so much smaller than other as to seem wanting.

Dicœcious : unisexual male and female in different individuals.

Disc : development of torus within calyx.

Discoid : having a disc.

Disk : disc.

Dissepiments : partition in an ovary.

Drupe : a superior monocarpellary succulent fruit in which the pericarp shows three distinct regions.

Drupel : diminutive of drupe.

Ebracteate : without bracts.

Echinate : beset with prickles.

Ellipsoid : an elliptic solid.

Elliptic : shaped like an ellipse.

Elongate : drawn out in length.

Emarginate : having a notch cut out usually at the extremity.

Embryo : the rudimentary plant formed in seed.

Endocarp : the inner layer of pericarp.

Epicalyx : an involucre resembling an accessory calyx.

Epicarp : the external layer of a pericarp.

Exalbuminous : without albumen.

Exserted : protruded beyond as stamens beyond corolla tube.

Exstipulate : without stipules.

Falcate : sickle-shaped.

Fascicled : connected into a close bundle of flowers, leaves, etc.

Filaments : stalks of anthers.

Filiform : thread shaped.

Fimbriate : with the margin bordered by long slender processes.

Flaccid : withered and limp.

Flexuose : zigzag.

Foliaceous : leafy.

Fronds : leaves of a palm or fern.

Fusiform : thick but tapering towards end.

Gamosepalous : having sepals united into one piece.

Gibbous : pouched, like a pouch.

Glabrous : without any hairs ; smooth.

Glands : a definite secreting structure on the surface.

Glaucous : covered with a bloom ; sea green.

Glumes : chaffy two ranked members of the inflorescence of grasses, etc.

Gynæcium : the female portion as a whole of a flower.

Hermaphrodite : having both the sexual organs.

Hesperidium : the fruit of the orange tribe.

Hilum : a scar left on a seed where it was attached to funicle or placenta.

Hispid : beset with rough hairs.

Hispidulous : minutely hispid.

Hyaline : transparent.

Hypogynous : free from but inserted beneath the pistil.

Imbricate : overlapping one piece entirely covered and one wholly external.

Imparipinnate : pinnate with an odd terminal leaf.

Incumbent : leaning upon.

Incurved : bending from without inwards.

Indehiscent : not splitting.

Inferior : below some other organ.

Inflexed : turned abruptly ; bent inward.

Inflorescence : the disposition of the flowers on floral axis.

Infrafoliar : below leafy portion.

Intercalated : interposed ; placed between.

Interfoliar : situated between two opposite leaves.

Intermediate : half way or between.

Introrsely : turned inward.

Involucel : a secondary partial involucre.

Involucre : a ring of bracts surrounding several flowers as in Compositæ.

Keel : carina, the two anterior and united petals of a papilionaceous corolla forming a ridge like the keel of a boat.

Laciniated : slashed, cut into narrow lobes.

Lanceolate : narrow, and tapering to each end.

Legume : the seed vessel of Leguminoseæ (one-celled and two valved but various in form).

Ligulate : furnished with a ligule.

Ligule : (1) strap shaped, as the limb of ray florets.

(2) thin scarious projection from the top of leaf sheath in grasses.

Linear : narrow and several times longer than broad.

Lobe : division of an organ or specially round division.

Loculicidal : the cavity of the pericarp dehising by back or the dorsal suture.

Lodicule : a small scale outside the stamens in flower of grasses; glumella.

Lomentum : a legume contracted between seeds and falling apart into one-seeded joints.

Longitudinal : in the direction of growth.

Lyrate : pinnatifed with the terminal lobe large and round, the lower ones smaller.

Mammillate : having teat-shaped processes.

Mesocarp : the middle layer of a pericarp.

Monadelphous : with one stamen, all stamens joined together and forming one staminal bundle.

Monœcious : having male and female flowers on the same plant.

Monopodium : the stem of a single and continuous axis.

Mottled : spotted in various colours.

Mucronate : possessing a short and sharp point as in some leaves.

Muricate : rough with short and hard tubercular exerscences.

Node : the part of a stem which normally has a leaf or a whorl of leaves.

Nodose : knotty, chiefly used of roots.

Nut : a hard and indehiscent one-seeded fruit.

Obcordate : inversely heart shaped.

Obellipsoid : inversely ellipsoid.

Oblanceolate : inversely lanceolate.

Oblique : of unequal sides.

Obovate : reversed ovate.

Obovoid : an obovate solid.

Odd pinnate : with a terminal leaflet.

Orbicular : of a flat body with a circular outline.

Ovate : shaped like a longitudinal section of a hen's egg.

Ovoid : an egg shaped solid.

Ovule : young seed in a ovary.

Pale : (1) the chaffy scales on the receptacles of many compositeæ.
(2) inner bract glume in grasses.

Palmate : lobed or divided so that sinuses point to the apex of the petiole ; palm shaped.

Palmi-lobed : divided like a palm.

Palmi-nerved : having nerves like the palm.

Panduriform : drawn into the middle, fiddle shaped.

Panicles : a loose flower cluster as a branched raceme or corymb.

Papilla : soft superficial glands.

Papilionaceous : butter-fly shaped corolla as in Leguminoseæ.

Papillose : covered with papilla.

Pappus : the various tufts of hairs on achenes or fruits.

Parietal : belonging to a wall.

Pedate : palmately divided with lateral division two cleft.

Pedicel : the ultimate flower stalk.

Peduncle : the general term for the stalk of a flower or a cluster of flowers.

Peltate : a leaf attached by its lower surface to a stalk.

Penulous : hanging.

Penicillate : pencil shaped.

Perianth : the floral envelopes (calyx and corolla both combined).

Pericarp : wall of a fructified ovary.

Perigynous : organs attached to the perianth or with the lower parts.

Persistent : remaining on the organ and not falling.

Petal : one of the leafy expansions of corolla.

Petiole : foot stalk of a leaf.

Petioled : having a petiole.

Pilose : hairy.

Pinnæ : the primary divisions of a pinnate leaf.

Pinnate : with leaflets arranged each side of a common petiole.

Pinnatifid : pinnately divided.

Pinnatisected : pinnately divided down to the rachis.

Pistil : female organ of a flower.

Pistillode : organ analogous to pistil.

Placenta : organ which bears the ovules in a ovary.

Placentation : the disposition of a placenta.

Plaited : folded into plaits or folds.

Pod : a dry and many seeded dehiscent fruit.

Polygamous : with hermaphrodite and unisexual flowers on the same.

Polymorphous : with several or various forms.

Polypetalous : having the petals separate.

Pome : an inferior fruit of several cells.

Procumbent : lying along the ground.

Pubescent : clothed with soft hairs.

Punctate : marked with dots or glands.

Pungent : ending with a rigid and sharp point.

Pyrene : a small stone of a drupe or similar fruit.

Pyriform : resembling a pear in form.

Raceme: an indeterminate or centripetal inflorescence with lengthened axis.

Rachis : axis of an inflorescence or a compound leaf.

Radical : arising from the root or its crown.

Receptacle : the torus; placenta.

Reniform : kidney shaped.

Repand : with slightly uneven margin.

Replum : a frame like placenta from which the valves fall away in dehescience.

Reticulate : net like.

Retuse : with a shallow notch and a rounded apex.

Rhizomatous : having rhizomes.

Rhizome : root stock; a stem of a root like appearance lying under ground.

Rind : outer bark of a tree or fruit.

Rostrate : with a beak.

Rosulate : collected into rosette or a collection of leaf.

Rotate : wheel shaped.

Rotundate : rounded.

Rudimentary : arrested in an early stage of development.

Rugulose : somewhat wrinkled.

Ruminate : looking as though chewed.

Saccate : bag shaped.

Saggitate : enlarged at the base into two acute straight lobes.

Scabrid : somewhat rough.

Scabrous : rough to the touch.

Scandent : climbing in whatever manner.

Scarious : thin dry and membraneous.

Semi-saggitate : saggitate on one side only.

Sepal : segment of a calyx.

Septa : any kind of partition.

Seriate : disposed in series of rows.

Serrate : beset with antrorse teeth on the margin.

Sessile : destitute of a stalk.

Setaceous : bristle like.

Sheath : a tubular part as the lower part of the leaf.

Sigmoid : double curved in opposite direction.

Silicule : a short silique not much longer than wide.

Siliqua : a peculiar pod of Cruciferæ.

Sinnuate : wavy.

Sinus : a recess or re-entering angle.

Spadix : a spike with a fleshy axis.

Spathaceous : spathe bearing or of the nature of a spathe.

Spathe : a large bract enclosing a flower cluster.

Spicate : like a spike.

Spike: an inderminate inflorescence with sessile flowers on a common elongated axis.

Spikelet : a secondary spike ; a cluster of one or more flowers subtended by a common pair of glumes.

Spiral : as though wound round an axis.

Spur : a hollow and slender extension of some part of a flower.

Spurred : having a spur.

Stalk : any lengthened support of an organ.

Stamens : one of the elements of an androceium consisting of anther and filament.

Staminode : a sterile stamen or its homologue without anther.

Standard : the posterior petal of a papilionaceous corolla.

Staple : the length of the cotton fibre.

Stellate : star-like.

Stipellate : furnished with a minute stipule on a partial petiole of compound leaf.

Stipe : the support of a gynoceium.

Stipitate : having a stipe.

Stipule : an appendage of a leaf on each side of the leaf insertion.

Stipulate : having stipules.

Stolon : a sucker, runner, or any basal branch which is disposed to root.

Stone : the hard endocarp of a drupe.

Strigose : beset with sharp pointed, appressed straight and stiff hairs, or bristles ; hispid.

Sub-acute : more or less acute.

Sub-glabrous : more or less glabrous.

Sub-hypogynous : more or less hypogynous.

Sub-terete : more or less terete.

Subulate : awl-shaped.

Sub-umbellate : more or less umbrella shaped.

Superior : growing or placed above.

Sympodium : a stem made up of a series of superposed branches, so as to imitate a simple axis.

Syncarpous : composed of two or more united carpels.

Tendril : a filiform process by which a plant may secure itself in its position.

Terete : cylindric and usually tapering.

Testa : the outer coat of a seed.

Tetradynamous : having four long stamens and two short.

Thyrse : a mixed inflorescence, a contracted or ovate panicle, the main axis inderminate but the secondary and ultimate axes cymose.

Thyrsoid : like a thyrse.

Tomentose : densely pubescent with matted wool or short hairs.

Tomentum : pubescence.

Torulose : cylindric with swollen portions at intervals somewhat moniliform.

Torus : the receptacle of a flower ; that portion of the axis on which the parts of the flower are inserted.

Trifoliolate : with three leaflets.

Trifoliate : trifoliolate.

Trigonous : three angled.

Triparite : divided into three parts.

Tripinnate : three times pinnate.

Triquetrous : three edged.

Truncate : as though cut off at the end.

Tuber : a thickened and short sub-terranean branch beset with buds or ' eyes '.

Tuberculate : beset with knotty projections.

Turbinate : shaped like a top.

Turgid : swollen but not with air.

Umbel : an inflorescence in which a cluster of pedicels spring up from the same point like the ribs of an umbrella.

Umbellate : having the inflorescence in Umbels.

Uniflorous : one flowered.

Unifoliate : having a compound leaf with one leaflet.

Unilateral : one sided.

Uniseriate : in one line.

Urceolate : pitcher like ; hollow and contracted at the mouth.

Utricle : a small bladdery pericarp.

Valvate : when parts of a flower bud meet exactly without over lapping.

Valve : a piece into which a capsule naturally separates at maturity.

Venation : the mode of veining.

Ventral : the anterior or inner face of a carpel.

Ventricose : inflated on one side.

Versatile : turning freely on its support.

Vesicles : a small bladder or cavity.

Villose : bearing long weak hairs.

Viscous : glutinous, clammy.

Vittæ : the aromatic oil tubes of the pericarp of Umbelliferæ.

Viviparous : germinating or sprouting from seed or bud while attached to the parent plant.

Wing : any membranous expansion attached to an organ ; a lateral petal of a papilionaceous corolla.

Whorl : the arrangement of organs in a circle round an axis.

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